August, 1930

Railway Engineering and Maintenance

SUPER
HIPOWER

Super Hipower Spring Washers have proved their capacity to prolong the life of frogs and crossings.

They are made especially powerful for the severest possible service.

No other device is as husky.

The NATIONAL LOCK WASHER COMPANY
Newark, New Jersey, U. S. A.

These crossing bolts are tight

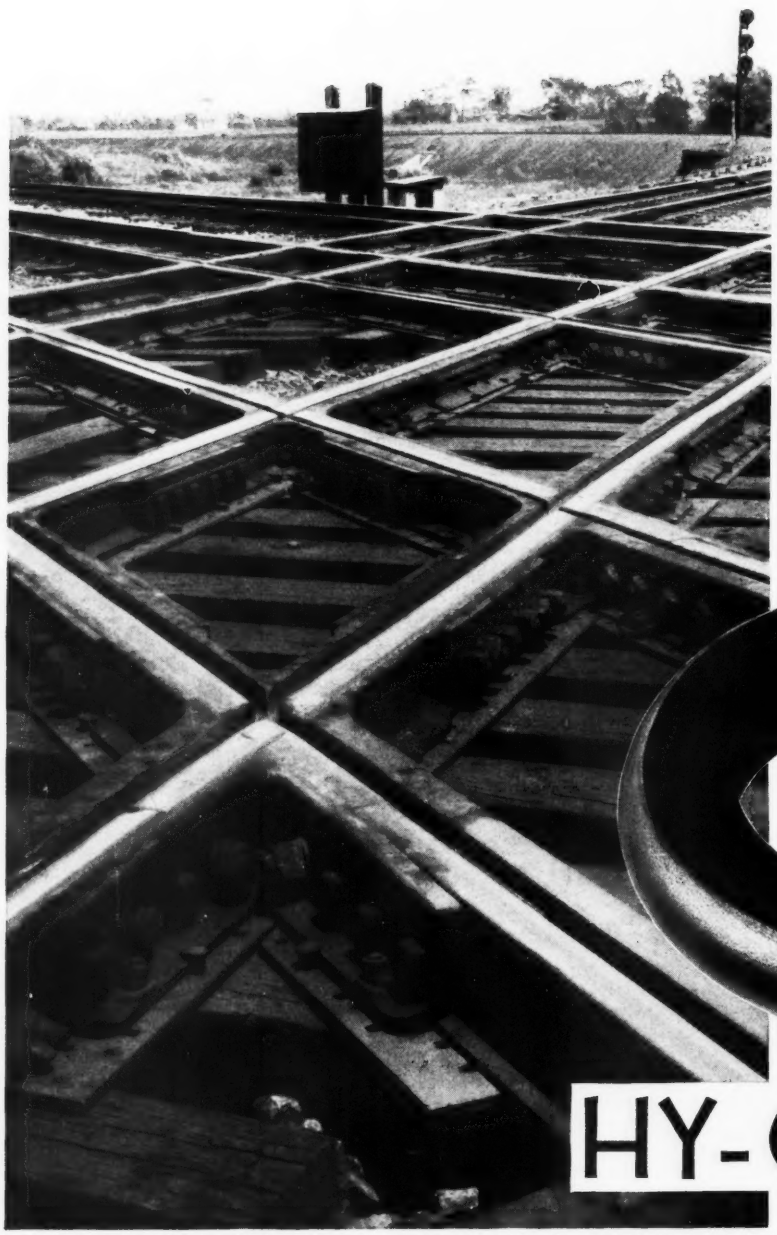
show little wear under tension..

THOUSANDS of crossings like this one on mainline tracks of many important railroads need less attention from track gangs than crossings unprotected by HY-CROME.

It is expensive to tighten track bolts periodically—and periodic tightening is necessarily frequent where HY-CROME spring washers are not used. Great reactive energy and wide reactive range in every HY-CROME spring washer is inherent, and the only means of automatic compensation for wear ever devised that is practical and economical.

Fast, heavy traffic induces terrific strains throughout the crossing in every direction, and it is here, where conditions are hardest, that HY-CROME most quickly proves its value. Determine spring washer efficiency by making the HY-CROME TRACK TEST.

THE
RELIANCE MANUFACTURING CO.
MASSILLON, OHIO
Engineering Materials, Ltd., McGill Bldg.
Montreal, Quebec, Canada



HY-CROME
Reg. U. S. Pat. Office

RAILWAY ENGINEERING AND MAINTENANCE
Published monthly by Simmons-Boardman Publishing Co., at 105 W. Adams St., Chicago. Subscription price: United States, Canada and Mexico, $2.00; foreign countries, $3.00 a year. Single copy, 35 cents. Entered as second class matter January 15, 1916, at the postoffice at Chicago, Illinois, under the Act of March 3, 1879.

Alphabetical Index to Advertisers, Page 56 Classified Index to Advertisers, 52-54

The Strongest Link Between Tie Preservation and Tie Conservation

THE LIFE of treated ties would be comparatively short if used in track without tie plates. The Lundie Tie Plate supplies the strongest link of protection against mechanical wear between tie preservation and tie conservation, by virtue of the bottom, with its series of rounded steps, which holds track to rigid gauge without cutting a single fibre of the tie.

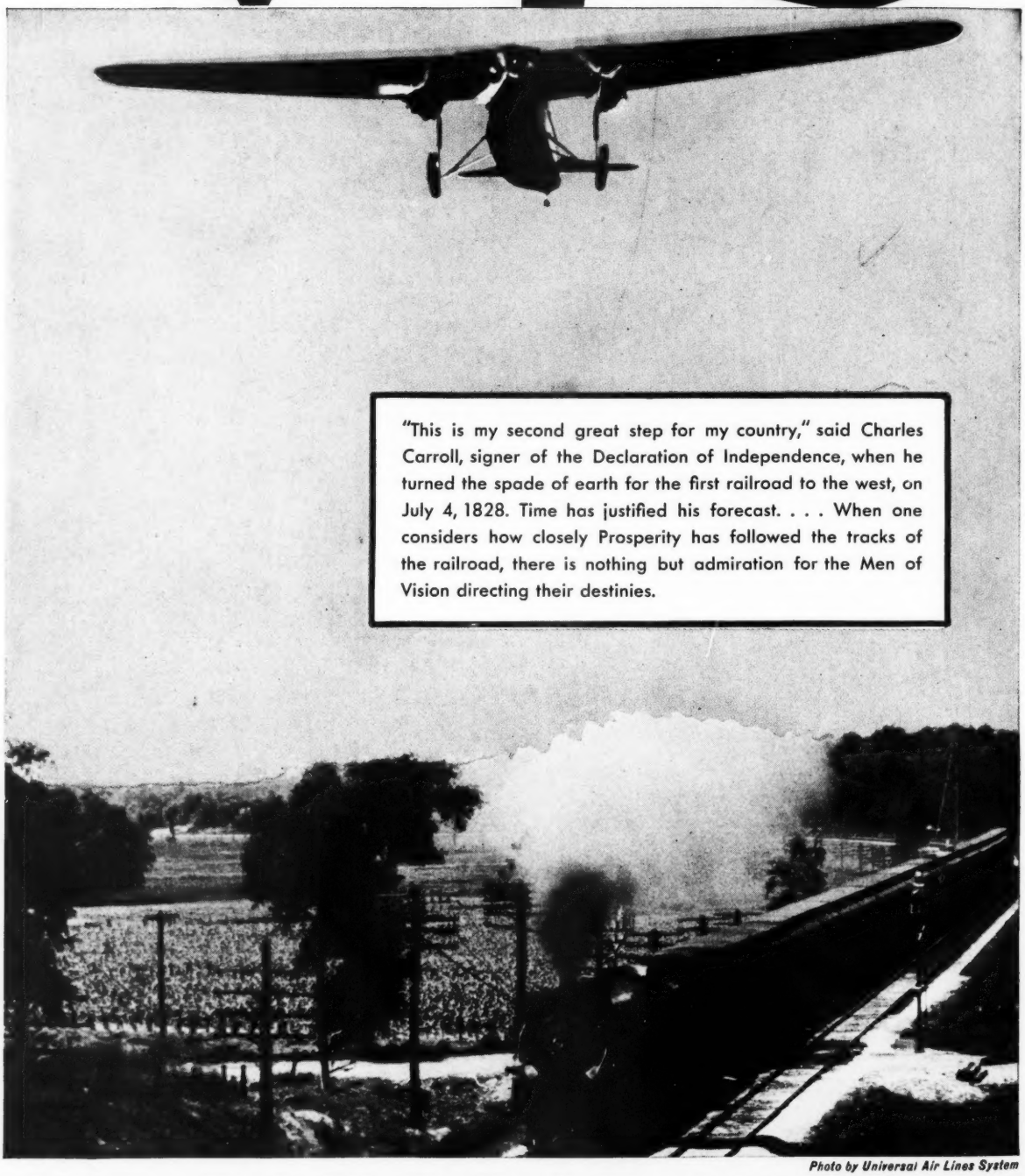
The Lundie Engineering Corporation

285 Madison Avenue, New York

59 East Van Buren Street, Chicago

LUNDIE TIE PLATE

VIS

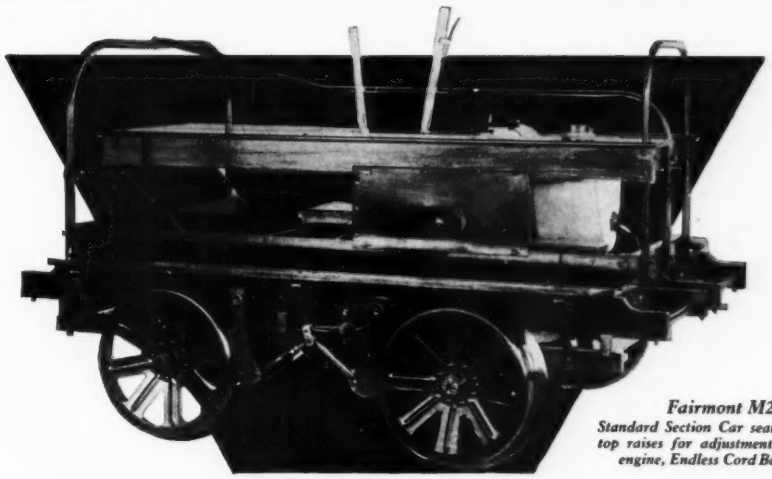


"This is my second great step for my country," said Charles Carroll, signer of the Declaration of Independence, when he turned the spade of earth for the first railroad to the west, on July 4, 1828. Time has justified his forecast. . . . When one considers how closely Prosperity has followed the tracks of the railroad, there is nothing but admiration for the Men of Vision directing their destinies.

Photo by Universal Air Lines System

THE RAILROAD WORLD

TON



Fairmont M2
Standard Section Car seats 10 men; top raises for adjustments; 6 H. P. engine, Endless Cord Belt Drive

Progress, whether measured in railroad systems or railway motor cars, depends upon foreseeing the needs of each dawning day. VISION made possible the brilliant expansion program of the railroads; and, in the sphere of motor cars, played the part that led to Fairmont supremacy.

Needs, as they developed, have always been anticipated by Fairmont. A survey of all worthy improvements, such as ball and roller bearing engines, show that the great majority were engineered and pioneered by Fairmont, in the striving toward ***"Lowest Over-All Cost Service."*** This goal has been attained —proved by the fact that ***over half the motor cars now in use are Fairmont products!***

FAIRMONT RAILWAY MOTORS, INC.
FAIRMONT, MINNESOTA, U. S. A.
General Sales Offices: 1356 Railway Exchange Bldg., CHICAGO
District Sales Offices: New York City Washington, D. C. St. Louis San Francisco New Orleans
FAIRMONT RAILWAY MOTORS, Ltd., Toronto, Canada *Foreign Representative:* BALDWIN LOCOMOTIVE WORKS
Manufacturers of section motor cars, inspection motor cars, gang and power cars, weed burners, ballast discers, ball and roller bearing engines, push cars and trailers, roller axle bearings, wheels, axles, and safety appliances

Fairmont Mudge
Performance on the Job Counts

KNOWS FAIRMONT

Protects against CORROSION

Where RED signals SAFETY

RED LEAD...*adds years to the Life of structural metal!*

IN tank and coal cars, signal towers, bridges... the most sturdy steel or iron needs protection. Air and moisture are their relentless foes. Unless kept away, they cause corrosion.

This Rugged Coat Protects for Years

There is no better way to safeguard structural metal from corrosion than by using pure red lead. Red lead seals up metal with a tough, dense, protective coat that lasts for years... that keeps air and moisture away from the metal. Thus, with the unfailing protection afforded by red lead, the life of metal is prolonged.

For more than a century, pure red lead has been the accepted paint for iron and steel. It is specified by leading engineers. It protects the armor of ships... the skeleton of skyscrapers... the sturdy steel of bridges, gas tanks and other metal structures.

Paste and Liquid Red Lead

For high-grade red-lead paint, Dutch Boy Red Lead has long been standard. Pure, fine and highly oxidized, it offers a measure of protection that no other pigment can give.

Dutch Boy Red Lead comes in two forms—paste and liquid. The liquid (ready for the brush) is supplied in six different colors... the natural orange-red, two shades each of green and brown ...and black. The paste comes in orange-red, and can be shaded to dark colors.

For information on any special painting problem, write our Department of Technical Paint Service, in care of our nearest branch.

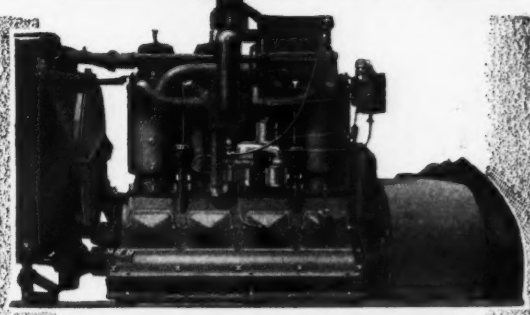
NATIONAL LEAD COMPANY

New York, 111 Broadway; Buffalo, 116 Oak Street; Chicago, 900 West 18th Street; Cincinnati, 659 Freeman Avenue; Cleveland, 820 West Superior Avenue; St. Louis, 722 Chestnut Street; San Francisco, 2240-24th Street; Boston, National-Boston Lead Company, 800 Albany Street; Pittsburgh, National Lead & Oil Company of Pa., 316 Fourth Avenue; Philadelphia, John T. Lewis & Bros. Company, Widener Building.

DUTCH BOY RED LEAD

"Save the surface and you save all"

NORTHWEST oil engine economy
NORTHWEST crawler versatility!



THE Northwest oil engine brings the railroad a new economy in the operation of cranes and shovels—the economy that comes with burning low cost fuel of low distillation range—economy plus the dependability that comes with gasoline.

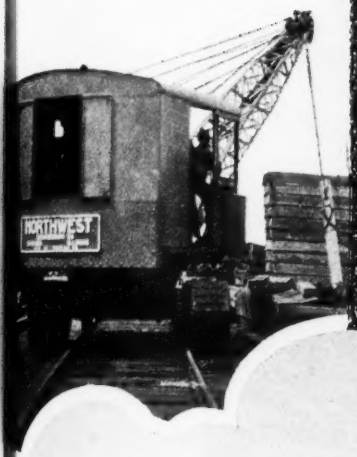
Combine this power plant with Northwest crawler versatility and you have an unbeatable combination for new construction, maintenance or store yard work.

Let us show you motion pictures of Northwests on railway work.

Northwest Engineering Co.

The world's largest exclusive builders of gasoline, oil burning and electric powered shovels, cranes and draglines

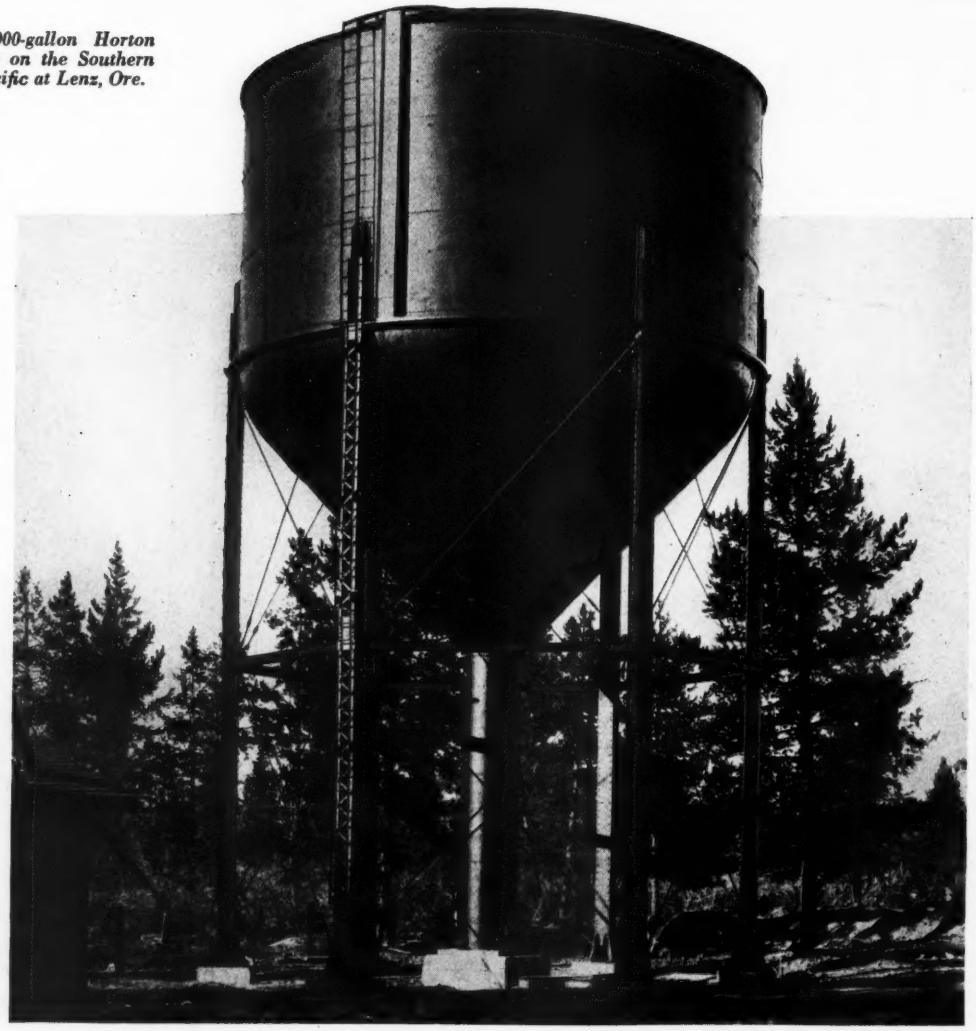
1713 Steger Bldg., 28 E. Jackson Blvd.
Chicago, Ill., U. S. A.



NORTHWEST

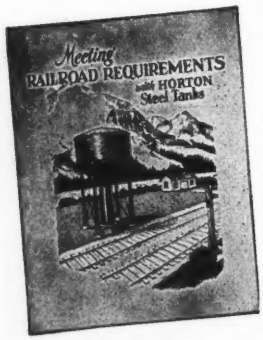
REM 8 Gray

ASK ABOUT THIS NEW POWER PLANT!



200,000-gallon Horton tank on the Southern Pacific at Lenz, Ore.

Elevated STEEL Tanks for Roadside Service



Ask for a Copy of this Booklet

Elevated steel tanks are used extensively for the delivery of water and oil to locomotives. They present a neat appearance and have long life. A coat of paint every few years is usually all the maintenance required to keep them in good condition.

Steel tanks are built in large standard sizes to accommodate the present day requirements with long engine districts. They may also be moved if operating conditions make changes in location of stations necessary.

Both the conical-bottom and ellipsoidal-bottom types of tanks have large risers, usually five or six feet. Where dirty water is encountered, the settlings collect in the bottom of the riser and are flushed out of the tank through a quick-opening valve.

Whenever contemplating new water or oil stations, or additions to existing stations, we will appreciate the opportunity of giving you estimating quotations on elevated or storage tanks to meet your requirements.

CHICAGO BRIDGE & IRON WORKS

Chicago	2452 Old Colony Bldg.	Detroit	1519 Lafayette Bldg.
New York	3156 Hudson Terminal Bldg.	Philadelphia	1609 Jefferson Bldg.
Cleveland	2202 Union Trust Bldg.	Atlanta	2136 Rhodes-Haverty Bldg.
Dallas	3309 Magnolia Bldg.	San Francisco	1007 Rialto Bldg.
Birmingham	1546 50th Street, N.	Boston	1522 Consolidated Gas Bldg.
Houston	1125 Electric Bldg.	Seattle	4313 Smith Tower

HORTON TANKS

NATURE'S "OK" of ARMCO Corrugated Iron PIPE

Simplifies the Choosing of Culverts

For more than 23 years the pictured culvert of Armco Corrugated Iron Pipe has served faithfully under the main line of an important western railway system. It is still in excellent condition.

NATURE plays no favorites. But Nature is definite and faultless in her judgments. That is why the records of strength and durability of Armco Culverts are the findings of Nature. No other test proves anything of value to the culvert user. None other provides a fair basis for deciding the respective merits of culverts.

Since 1906—for more than 24 years—Armco Culverts have effectively drained the railroads and the highways of the United States and Canada. They have been under constant test by Nature. Today, as always, Nature OK's this pure iron product as the longest-lasting corrugated Metal drainage product on the market.

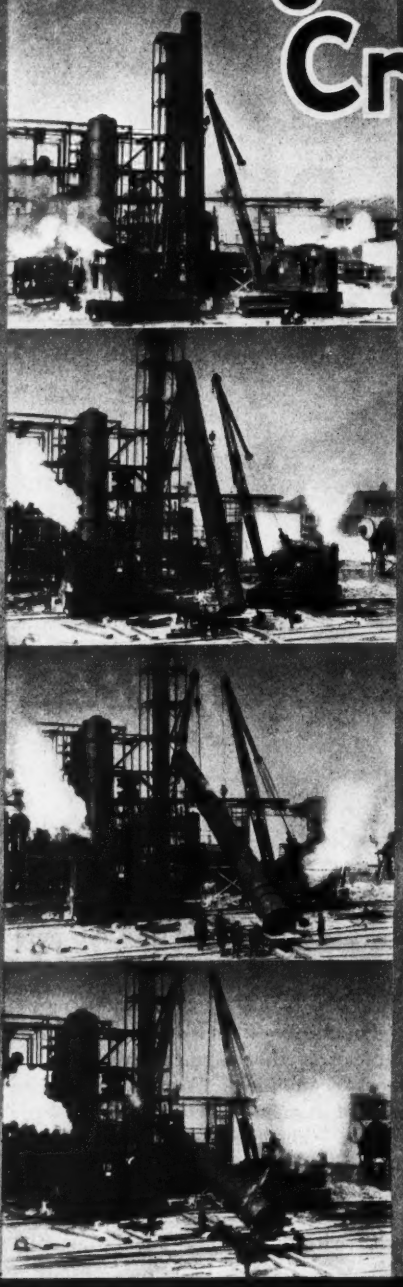
Their exceptional durability is the best indication that Armco Culverts are the most economical. More than 50,000,000 feet of Armco Corrugated Iron Pipe are in use. The facts about culvert performance under every condition of service are available, so that you, too, may easily choose culverts. Without obligating yourself, write to Drainage Headquarters.

Armco culverts and drains are manufactured from the Armco Ingot Iron of The American Rolling Mill Company and always bear its brand

ARMCO CULVERT MANUFACTURERS ASSOCIATION
Middletown, Ohio

© 1930, A.C.M.A.

Erecting a 70-Ton Cracking Still



...with

ORTON LOCOMOTIVE CRANES

...ndling and dependab...
...equipment.

The cylinder was made of metal 8 inch... in thickness, 7 feet in diameter and 75 fe... in length, and was installed recently in one ... the largest refineries in the Middle West.

A roller skid was placed under the low... end, and a hitch made about 25 feet from ... upper end, two ORTON Model "Y" standar... gauge locomotive cranes being used.

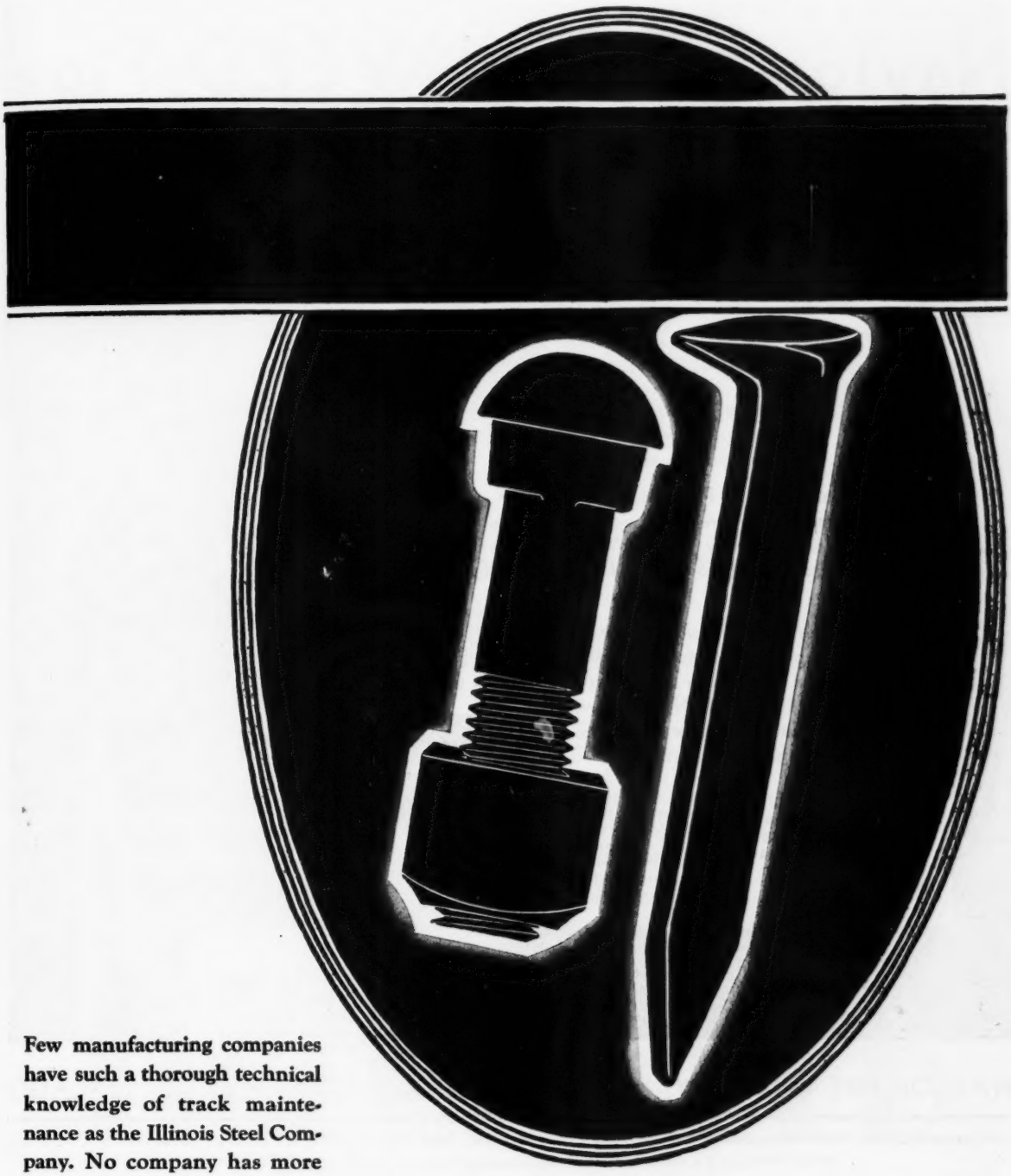
Hoist, Slue and Travel at the Same Time

As shown by the illustrations, the upper e... was hoisted half way, and the lower e... pulled between the two cranes. From this po... it was necessary for the cranes to tra... toward one another, to slue and to hoist at t... same time, in order to get the cylinder in ... vertical position and to spot the lower e... on the foundation.

This required accurate control of the ho... ing, sluing and traveling mechanisms, with a... solute sureness of clutch and brake actio... Stability of the cranes under capacity lo... also was required because outriggers cou... not be used while the machines were travelin...

These are some of the features which di... tinguish ORTON cranes of the locomotive an... crawler types, and insure their long and de... pendable performance in everyday work as... well as in out-of-the-ordinary lifting jobs such... as this particular one.

ORTON CRANE & SHOVEL CO.
608 S. Dearborn St., Chicago, Ill.
Representatives in Principal Cities



Few manufacturing companies have such a thorough technical knowledge of track maintenance as the Illinois Steel Company. No company has more efficient facilities for the manufacture of Spikes and Bolts, or a more thorough system of inspection. Add to these advantages that of *central location* and you have the reasons for the wide use among railroads of Illinois Spikes and Bolts.

Illinois Steel Company
Subsidiary of United States Steel Corporation
General Offices: 208 South La Salle Street
Chicago, Illinois

Naylor SPIRALWELD Pipe

Combines the *Three* Requirements of a Dependable Carrier

DUE to its exclusive *spiralwelded* lock-seam truss, Naylor *Spiralweld* Pipe has a structure that provides

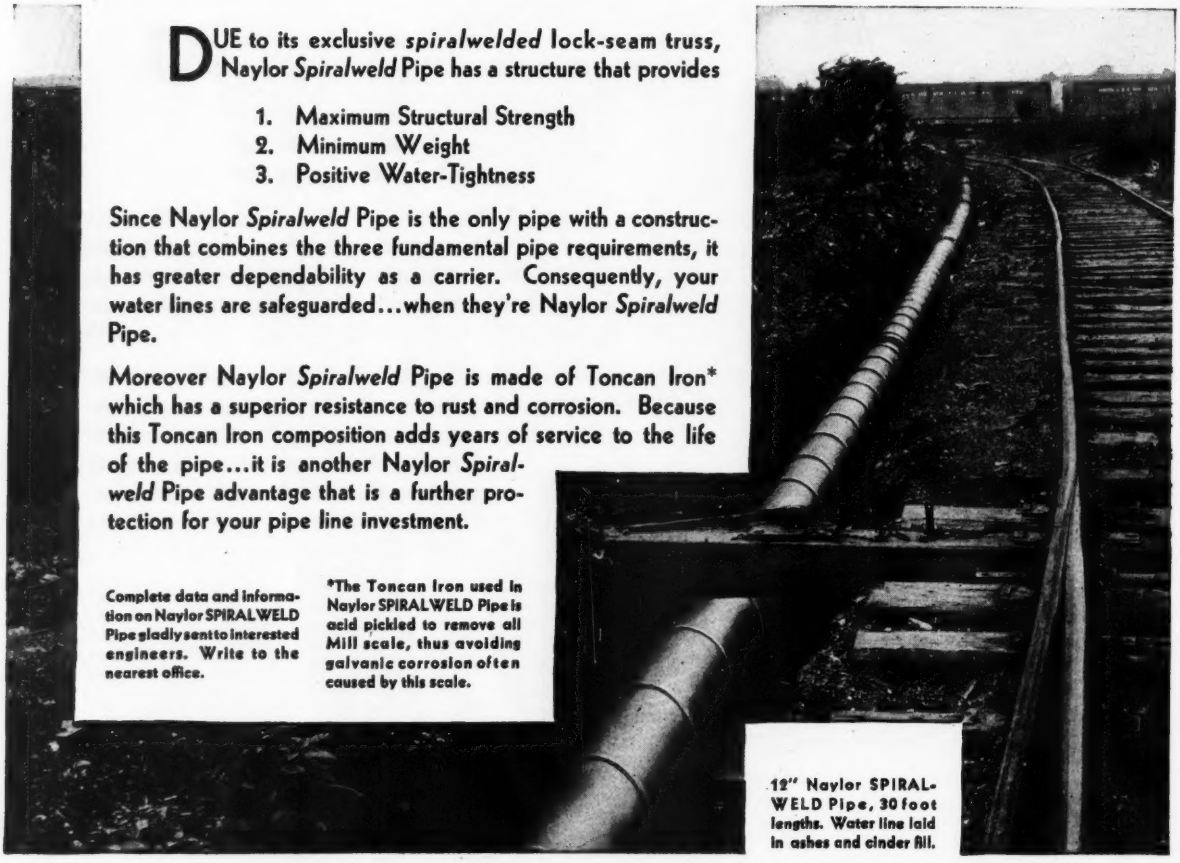
1. Maximum Structural Strength
2. Minimum Weight
3. Positive Water-Tightness

Since Naylor *Spiralweld* Pipe is the only pipe with a construction that combines the three fundamental pipe requirements, it has greater dependability as a carrier. Consequently, your water lines are safeguarded...when they're Naylor *Spiralweld* Pipe.

Moreover Naylor *Spiralweld* Pipe is made of Toncan Iron* which has a superior resistance to rust and corrosion. Because this Toncan Iron composition adds years of service to the life of the pipe...it is another Naylor *Spiralweld* Pipe advantage that is a further protection for your pipe line investment.

Complete data and information on Naylor SPIRALWELD Pipe gladly sent to interested engineers. Write to the nearest office.

*The Toncan Iron used in Naylor SPIRALWELD Pipe is acid pickled to remove all Mill scale, thus avoiding galvanic corrosion often caused by this scale.



12" Naylor SPIRALWELD Pipe, 30 foot lengths. Water line laid in ashes and cinder fill.

NAYLOR PIPE COMPANY, Main Office & Plant, 1230 E. 92nd St., CHICAGO

SALES OFFICES

3116 Chrysler Bldg. New York ◆ Witherspoon Bldg. Philadelphia ◆ 507 Philtower Bldg. Tulsa ◆ 2301 Commerce St. Houston ◆ 402 Petroleum Bldg. Ft. Worth

MONTREAL, CANADA: Mechanical Equipment Company, 660 St. Catherine St., West

TONCAN COPPER

Naylor Pipe

Maximum Structural Strength Mo-lyb-den-um With Minimum Weight

IRON

Standardized Naylor Pipe is made in sizes 6" to 12" I. D. and 14" to 20" O. D. in any uniform length desired up to 40'0". Ends made to wrought pipe standards for all types of coupling.

Toncan Copper Molybdenum Iron possesses a superior corrosion resistance, making it the favored pipe material.

Where corrosion is not a problem, Naylor Pipe can be furnished in steel.

Announcing..

Type-BW2

a Great Advance in Signal Bonds...

In presenting Tiger-Weld Signal Bonds—the American Steel & Wire Company is proud of the achievement represented by this development. You will welcome Tiger-Weld Signal Bonds for five reasons.

1. A new type construction makes them much stronger—and able to resist vibration to the utmost. Composed of solid steel terminals flash butt welded to a flexible rope stranded conductor composed of 6 strands of 19 wires made of fatigue resisting steel surrounding a 19 wire copper core.
2. They relieve the welder of the difficult job of trying to make a perfect weld between the strand and the rail.
3. When flame welded, a welder can install many more of these bonds in a day's time—and do much better work. These bonds can also be installed readily with a steel electrode and arc welding apparatus.
4. Their superior resistance to vibration assures long life and uninterrupted service.
5. They make possible new factors of safety.

Samples and detailed information will be sent on request—and our engineers will cooperate in demonstrating the application of Tiger-Weld Signal Bonds to your own rails.

TIGER-WELD SIGNAL BONDS

AMERICAN STEEL & WIRE COMPANY

208 S. La Salle Street, Chicago — SUBSIDIARY UNITED STATES STEEL CORPORATION — 30 Church Street, New York

Other Sales Offices: Atlanta Baltimore Birmingham Boston Buffalo Cincinnati Cleveland Dallas Denver Detroit Kansas City Memphis Milwaukee Minneapolis-St. Paul Oklahoma City Philadelphia Pittsburgh Salt Lake City St. Louis Wilkes-Barre Worcester

U. S. Steel Products Co.: San Francisco Los Angeles Portland Seattle Honolulu

Export Distributors: United States Steel Products Co., 30 Church St., New York City

Speed and Comfort are Desirable—Safety is Essential

The Rail Joint Company

165 Broadway, New York, N. Y.

MAKE R L BETTER

This

Simple Way

The beveling of rail at the joints, a feature of the TELEWELD process for the restoration of chipped and battered rail ends, has met with so much favor as a means of eliminating the chipping of rail ends that we now offer it as a specialized TELEWELD process and suggest its use on new and recently laid rail.

This new TELEWELD unit consists of a small track car on which is mounted a gasoline driven generator powering two electric grinders. The ⅛ inch grinder stones are encased in steel frames and secured to the rail to insure a true and perfect cut. Three men with one TELEWELD unit can bevel and slot two track miles of rail a day.

For your protection all TELEWELD processes are patented. The cost is nominal, the saving is tremendous. A TELEWELD engineer will conduct a survey of your rails free of cost and obligation. Send for him today. Know the full facts of TELEWELD value. Investigate the life lengthening possibilities of all TELEWELD processes.

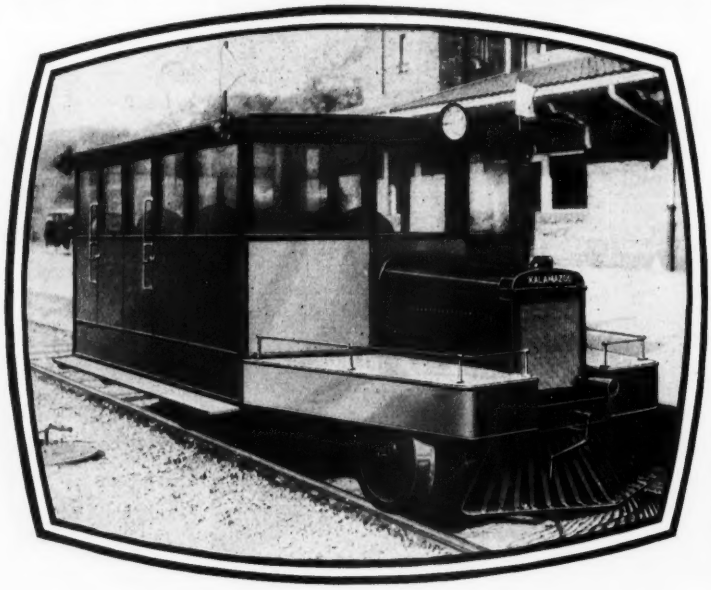
ELECTRIC RAILWELD
SALES CORPORATION
RAILWAY EXCHANGE BLDG • CHICAGO

New York • Cleveland • Salt Lake City • Boise • Spokane • San Francisco

A MILE AT A TIME

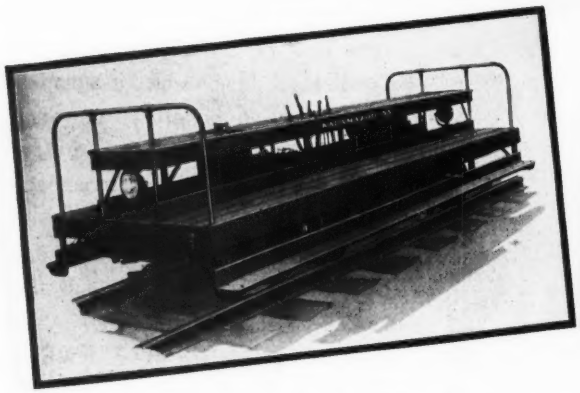
SERVICE of an Ever-Widening Scope

KALAMAZOO MEANS SERVICE TO YOU



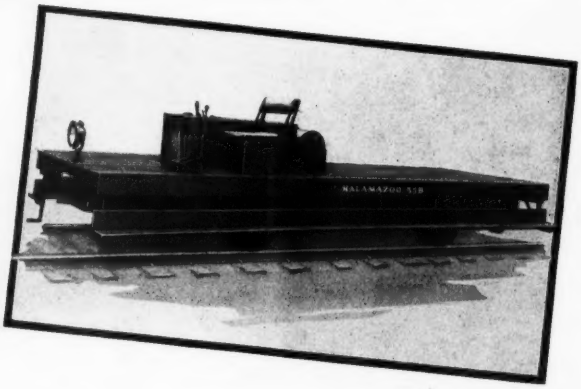
The Luxurious Kalamazoo 55-12

The 12 passenger Officials' Inspection Car. Deep bus type seats. Inspection parties or passengers ride mile after mile in this car without fatigue. It's built for comfort, safety and speed.



Kalamazoo Heavy Work Car No. 55

Seats 50 men and has ample power to haul several loaded trailers



Kalamazoo Heavy Work Car No. 55-B

This is the No. 55 car, without superstructure, showing how a large flat deck space may be provided for loading materials. This car is ideal for use on logging railroads or for carrying large construction gangs.

Established in 1883, we are still pioneers in the development of labor, money, and time-saving motor cars and other track equipment that meet and anticipate the constantly growing needs of American and foreign railroads.

The series of "Kalamazoo 55 Motor Cars" is so designed that it is adaptable to many kinds of service. Special types of bodies may be applied to the standard 55 chassis in order to satisfy specific requirements.

ESTABLISHED 1883

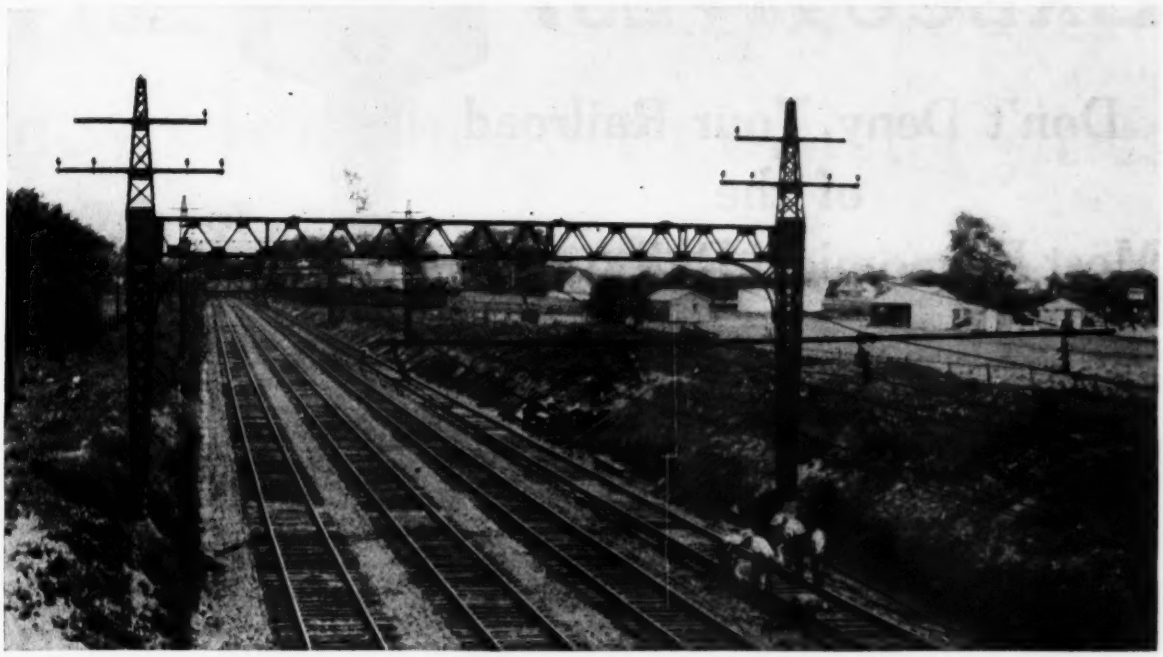
Complete catalog information promptly sent on request

KALAMAZOO RAILWAY SUPPLY CO.

MANUFACTURERS—Established 1883

KALAMAZOO, MICHIGAN, U. S. A.

ELECTRICITY IS THE MODERN POWER



SYNTRON ELECTRIC TIE TAMPERS

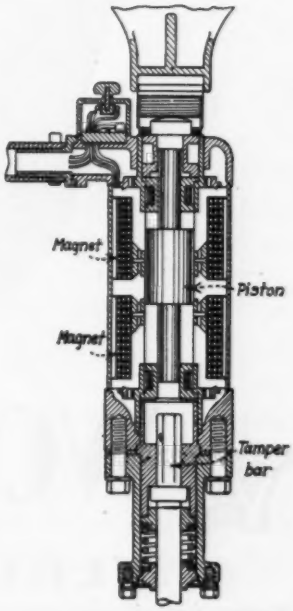
Fewer Men, Smaller Gangs
Less Gas and Oil
Smaller, Easier Moved Equipment
Constant Power

Tie Tamper Power Plants Will Operate

NUT TIGHTENERS
SCREW SPIKE DRIVERS
SPIKE DRIVERS
RAIL DRILLS
RAIL SAWS
RAIL MILLERS
PORTABLE DRILLS
PORTABLE SAWS
PORTABLE HAMMERS
PORTABLE GRINDERS
ARC WELDERS
RAIL GRINDERS
FLOOR LIGHTS

Cross section showing simple design and construction of electro-magnet, hammer blow tamper.

Built in 4-6-8-12 Tool Outfits



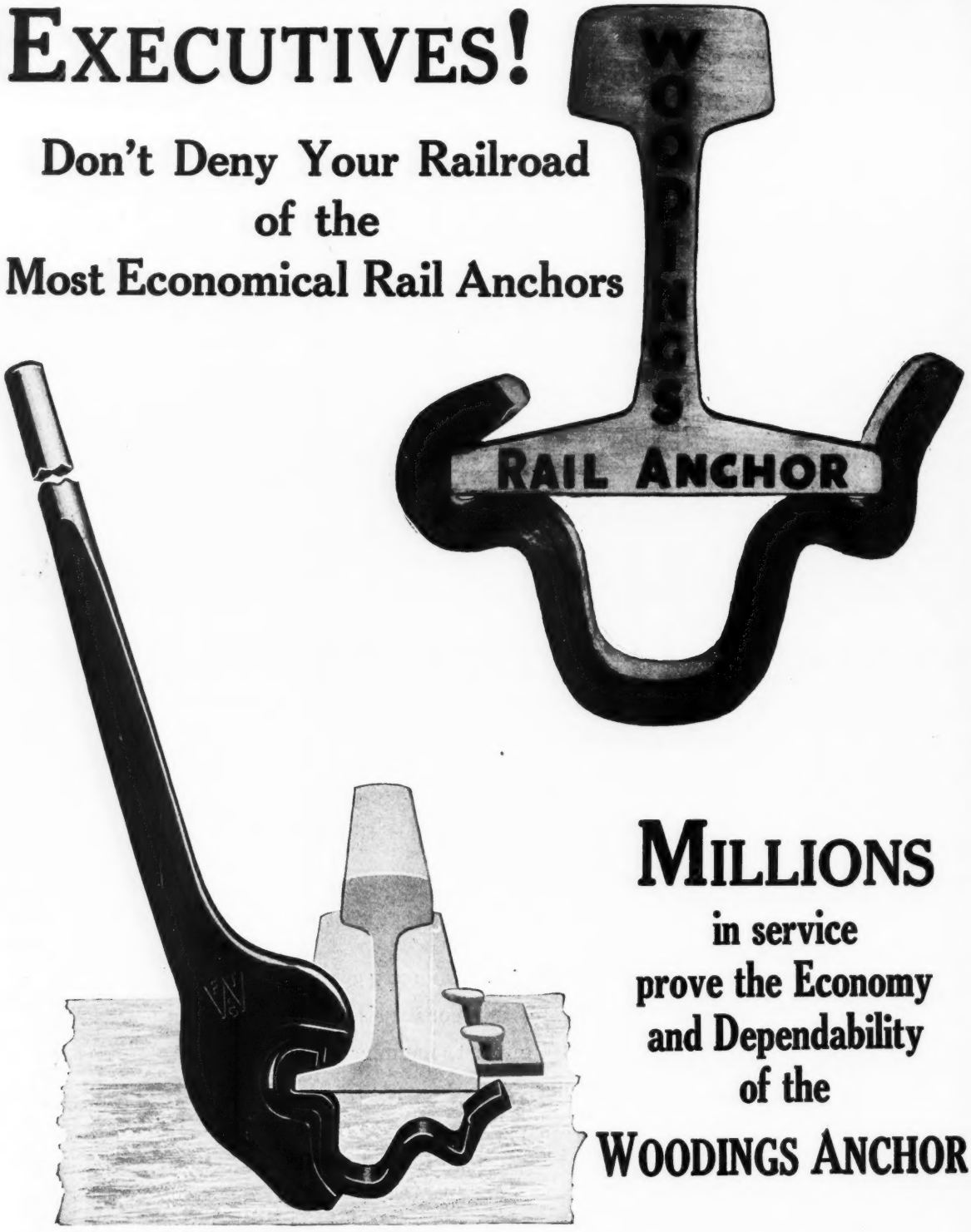
SYNTRON CO.

Pittsburgh, Pa.

15 Factory Service Branches

EXECUTIVES!

Don't Deny Your Railroad of the Most Economical Rail Anchors



MILLIONS

in service prove the Economy and Dependability of the

WOODINGS ANCHOR

WOODINGS FORGE & TOOL CO.

WORKS AND GENERAL OFFICES

VERONA, PENNA.

Here is how Cheaply you can now Telephone to other Cities

Your customers are no further away than the telephone on your desk

THIS CHART SHOWS THE STATION-TO-STATION DAY RATES BETWEEN REPRESENTATIVE CITIES

	Atlanta Ga.	Boston Mass.	Chicago Ill.	Cincinnati Ohio	Cleveland Ohio	Denver Colo.	Detroit Mich.	Indianapolis Ind.	Milwaukee Wis.	Newark N. J.	New Haven Conn.	New York N. Y.	Omaha Neb.	Philadelphia Pa.	San Francisco Cal.	St. Louis Mo.	Washington D. C.
Atlanta, Ga.		3.50	2.35	1.65	2.15	4.50	2.35	1.75	2.55	2.75	3.25	3.00	3.00	2.55	7.75	1.95	2.35
Boston, Mass.	3.50		3.25	3.00	2.35	6.50	2.55	3.00	3.25	1.05	.70	1.00	4.50	1.25	9.50	3.75	1.65
Chicago, Ill.	2.35	3.25		1.20	1.45	3.50	1.15	.90	.50	2.75	3.00	3.00	1.80	2.55	6.75	1.25	2.55
Cincinnati, Ohio	1.65	3.00	1.20		1.25	4.00	1.15	.60	1.50	2.35	2.55	2.35	2.55	2.15	7.25	1.45	1.80
Cleveland, Ohio	2.15	2.35	1.45	1.25		4.50	.60	1.25	1.65	1.70	1.95	1.80	3.00	1.60	7.75	2.05	1.45
Denver, Colo.	4.50	6.50	3.50	4.00	4.50		4.25	3.75	3.50	6.00	6.25	6.00	2.05	5.75	1.75	3.25	5.50
Detroit, Mich.	2.35	2.55	1.15	1.15	.60	4.25		1.15	1.25	1.95	2.15	2.05	2.75	1.85	7.50	1.95	1.70
Indianapolis, Ind.	1.75	3.00	.90	.60	1.25	3.75	1.15		1.20	2.55	2.75	2.55	2.15	2.15	7.00	1.10	2.05
Milwaukee, Wis.	2.55	3.25	.50	1.50	1.65	3.50	1.25	1.20		3.00	3.00	3.00	1.75	2.75	6.75	1.50	2.55
Newark, N. J.	2.75	1.05	2.75	2.35	1.70	6.00	1.95	2.55	3.00		.50	.15	4.00	.50	9.00	3.25	1.00
New Haven, Conn.	3.25	.70	3.00	2.55	1.95	6.25	2.15	2.75	3.00	.50		.50	4.25	.80	9.25	3.50	1.30
New York, N. Y.	3.00	1.00	3.00	2.35	1.80	6.00	2.05	2.55	3.00	.15	.50		4.25	.50	9.00	3.25	1.05
Omaha, Neb.	3.00	4.50	1.80	2.55	3.00	2.05	2.75	2.15	1.75	4.00	4.25	4.25		4.00	5.25	1.65	3.75
Philadelphia, Pa.	2.55	1.25	2.55	2.15	1.60	5.75	1.85	2.35	2.75	.50	.80	.50	4.00		8.75	3.00	.75
San Francisco, Cal.	7.75	9.50	6.75	7.25	7.75	1.75	7.50	7.00	6.75	9.00	9.25	9.00	5.25	8.75		6.50	8.50
St. Louis, Mo.	1.95	3.75	1.25	1.45	2.05	3.25	1.95	1.10	1.50	3.25	3.50	3.25	1.65	3.00	6.50		2.75
Washington, D. C.	2.35	1.65	2.55	1.80	1.45	5.50	1.70	2.05	2.55	1.00	1.30	1.05	3.75	.75	8.50	2.75	

It is your business pathway to the world . . . quick, convenient, inexpensive

THE TELEPHONE takes you "there and back" in minutes. You can transact business over thousands of miles without leaving your desk. "See" as many people as you wish. Give or receive a definite answer immediately . . . at a saving of time and money.

There are two kinds of out-of-town calls: *person-to-person*—when you ask the operator to summon a specific person to the telephone; and *station-to-station*—when you will talk with any one who answers. Station-to-station calls are cheaper. The charges can be reversed without additional cost on person-to-person calls and on many station-to-station calls.

Features of Bell Telephone service which are of particular aid in sales work include the *Key Town Plan*, for covering territories from key cities by telephone . . . *Sequence Calling Lists*, for putting through any number of calls in rapid succession . . . *Credit Cards*, which make it possible for traveling representatives to charge their telephone calls to the home office.

Doing business by telephone widens the sphere of your activities. There have been four reductions in inter-city telephone rates during the past four years. The average Long Distance call goes through in approximately two minutes. Bell Telephone service is *Quick . . . Convenient . . . Inexpensive.*

KREOLITE

SOLID UPLAND MOUNTAIN OAK R.R. CROSS AND SWITCH TIES

The favorable location of our several Plants enables us to purchase solid Upland Mountain Oak to advantage.

The life of treated timber depends upon the character of the preservative used. **We distill our own Creosote Oil.** By so doing it is possible for us to insure to the purchaser a uniform pure product of any grade desired.

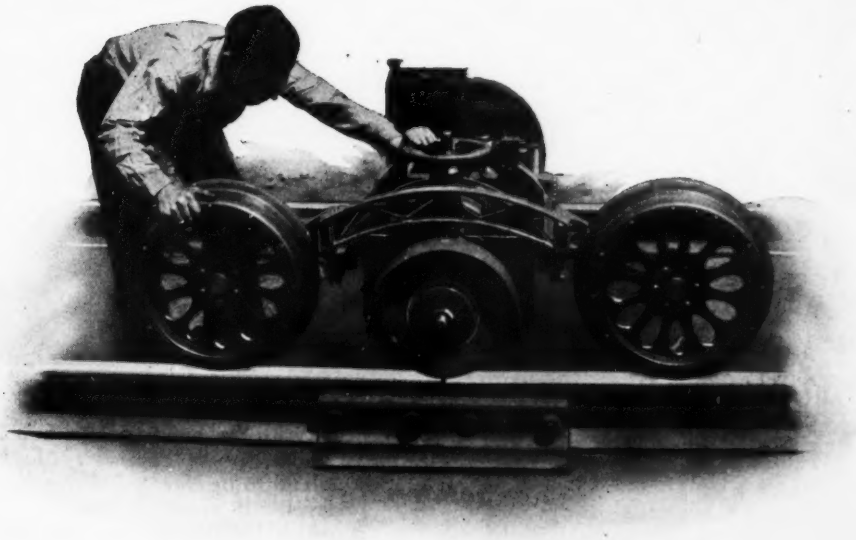
Enormous stocks of Cross Ties, Switch Ties, Structural Timbers and Piling, in all sizes, in Solid Oak or Pine, properly sticked and air seasoned before treatment, available for prompt shipment from Toledo, Ohio, or our Midland Creosoting Company plant, Granite City, Ill. (East St. Louis).

THE JENNISON-WRIGHT COMPANY, TOLEDO, OHIO

Branches in All Large Cities

R.R. TIES

A machine-tool *for track-maintenance*



HERE are Track Grinders designed especially for removing surplus metal deposited on the rail by arc welding to build up cupped joints and worn special work.

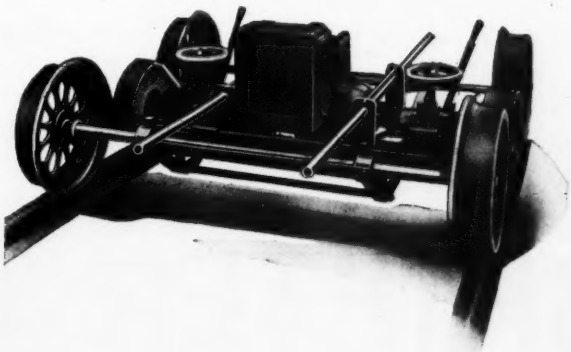
The motor-driven 12" diameter, 1½" face high-speed grinding wheel operates at 9,500 surface feet per minute.

A hand wheel provides vertical adjustment to feed the grinding wheel to the work. Lateral adjustment is equally simple. The track wheels, standard steam road type, are insulated.

Model P-3 has one grinding wheel. A lever jack makes it easy to raise and turn the machine to grind the opposite rail. It weighs 500 lbs.

Model P-2 is a two-head grinder, each head working independently. It weighs approximately 800 lbs.

This machine will do high speed track-grinding in a thoroughly satisfactory manner.



Descriptive literature on request.

Railway Track-work Co.

3132-48 East Thompson Street, Philadelphia

AGENTS

Chester F. Gailor, 50 Church St., New York
Chas. N. Wood Co., Boston
H. F. McDermott, 208 S. LaSalle St., Chicago
F. F. Bodler, San Francisco, Cal.
H. E. Burns Co., Pittsburgh, Pa.
Equipment & Engineering Co., London

A 300.000 yard fill-a 21 foot raise

With the building of a new levee near Dallas, it was necessary for the Rock Island to be elevated above the new flood level. It meant a raise of 21 feet for which 300,000 yards of fill were required. Above is a general view of the job, while at the left is one of the two Nordberg Track Shifters used in raising the tracks as the fill increased in height.

On similar construction projects, also for railroads, mines and quarries, or wherever track must be shifted and raised, this machine with a few men will take the place of a large gang ordinarily required where hand methods are employed. Its labor saving feature and the elimination of lost time to work trains on the dump tracks are of vital importance to those confronted with the problem of raising and shifting track. In these days of close competition, no longer can any one afford to continue with obsolete hand methods where modern machinery is available. For shifting and raising track, this unusual machine will soon pay for itself out of labor savings.

Furnished in both standard and narrow gauge types. Let us prove to you how it can save money on your jobs. Bulletin YE-8 describes it.

Railway Equipment Department

Nordberg Mfg. Co. - Milwaukee, Wis.

THE NORDBERG PATENTED TRACK SHIFTER

Beware

the "*special feature*" sidetrack

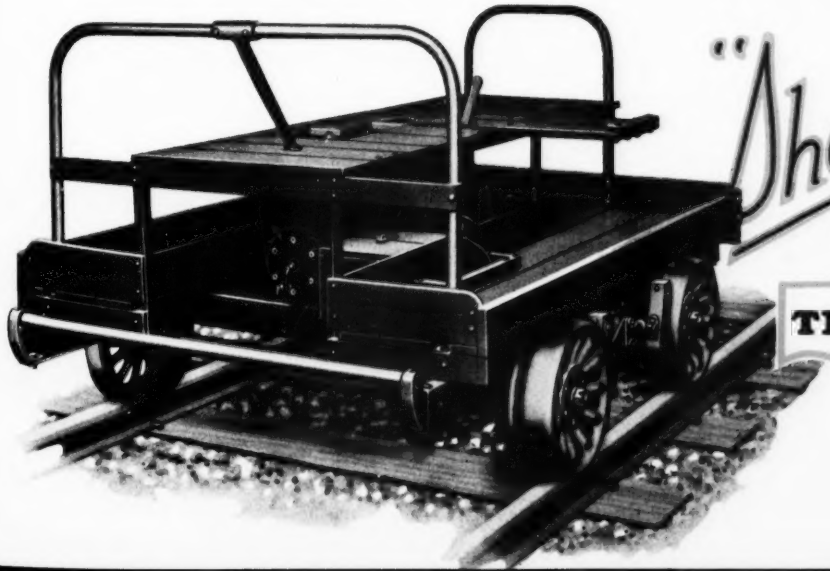
1930
begins the
SECOND CENTURY
of building
FAIRBANKS SCALES

Experienced buyers of railway motor cars know that the only way to arrive at motor car value is to stay on the "main line"—to investigate *every part* of the construction thoroughly. Sidetracks—"special features" that may be very desirable in themselves—are sometimes made to look so important that the balance of the construction is taken for granted.

You are not urged to buy a Sheffield Motor Car because of two or three "special features." *Every part* of the "Sheffield" will stand the closest inspection. *Every part* is built to give maximum service. There is no compromise to price. No cheapened construction that needs to be covered up by drawing attention to minor refinements.

Before you buy a railway motor car, gets the facts about "Sheffield." Investigate *every part.* You will then understand why the "Sheffield" is the *lowest over-all cost car on the market.*

First on the rails—and *still first*



"Sheffield "44B"

TIMKEN BEARING EQUIPPED

FAIRBANKS-MORSE

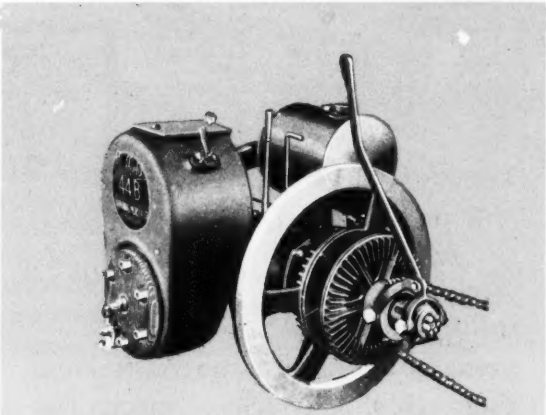
MOTOR CARS

POWER PUMPING AND WEIGHING EQUIPMENT

Compare the *Sheffield* "44B" Engine with other engines

Motor car dependability rests, first of all, upon the engine. Let's look at the single cylinder power plant that has helped to make the Sheffield "44B" famous for economy and long-life.

Advanced design is apparent at once —as you would expect in the product of an organization that has shown the way in engine building for over 40 years. An efficient, air-cooled cylinder head, in conjunction with water cooling, permits new operating economy. Patented piston design incorporates aluminum alloy head of special shape.



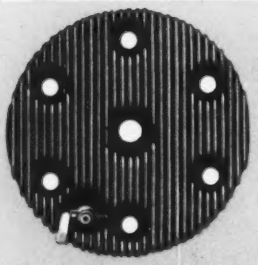
The complete power unit of the Sheffield "44B."

The large crankshaft and the connecting rods are drop forged, heat treated carbon steel. Timken Bearings are used. All parts are precision built and carefully fitted.

If you are interested in improved motor car dependability and in cutting maintenance costs let us send you complete information about Sheffield "44B" construction. *Every part* is important. *Every part* should be investigated *thoroughly.*

FAIRBANKS, MORSE & CO.
900 S. Wabash Ave., CHICAGO

1930 begins the SECOND CENTURY of building FAIRBANKS SCALES

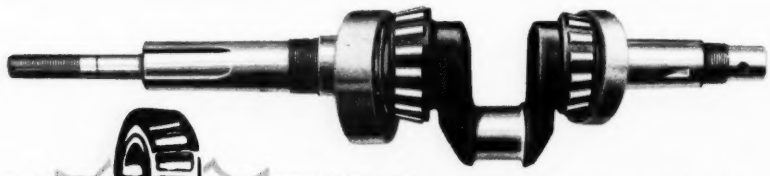


Top view of the air-cooled cylinder head used in addition to water cooling.

Patented white top piston used in Sheffield "44B" Engine.

Manufacturers of railway motor cars; hand cars; push cars; velocipedes; standpipes for water and oil; tank fixtures; stationary and marine oil engines; steam, power and centrifugal pumps; scales; motors and generators; complete coaling stations.

First on the rails . . . *and still first*

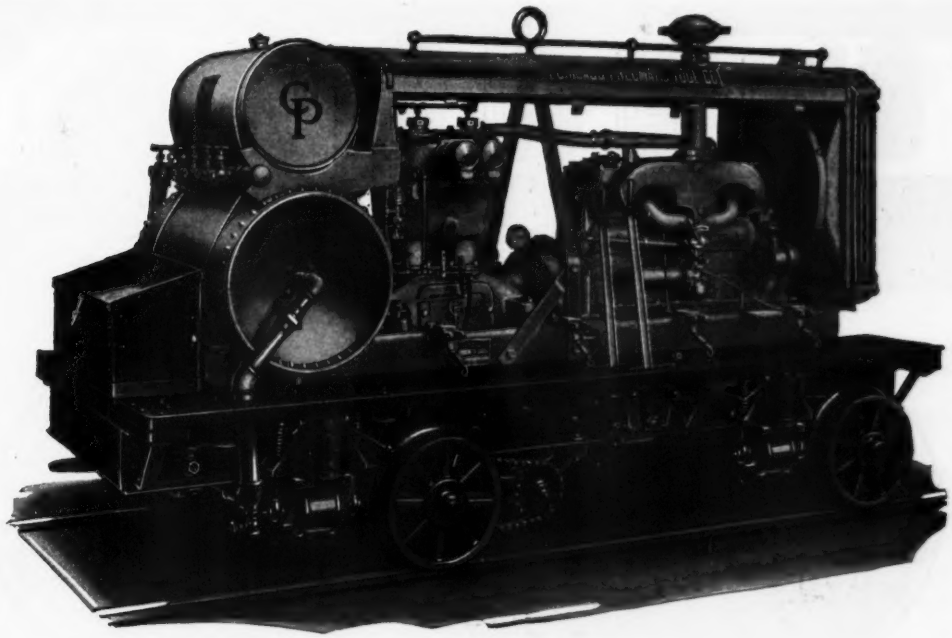


Unusually large crankshaft. Outer races have been moved aside to show the Timken Bearings.

TIMKEN BEARING EQUIPPED

RA21.70

FAIRBANKS-MORSE
MOTOR CARS



CP Self-Propelled Compressor with Air Motor Drive

ALL CP Self-Propelled Gasoline Driven Compressors are equipped with a simple, rugged Air Motor Drive. A single handlever controls the travel of the unit in either direction without the use of troublesome clutches or gears. Other features of all CP Railroad mounted Portable Compressors are—roller bearings for the flanged wheels, combination transverse wheels and air-operated lifting jacks, lifting bale, Alemite lubrication for running gear of truck, aftercooler, convenient air outlets and roomy tool box. Write for Bulletin No. 789.

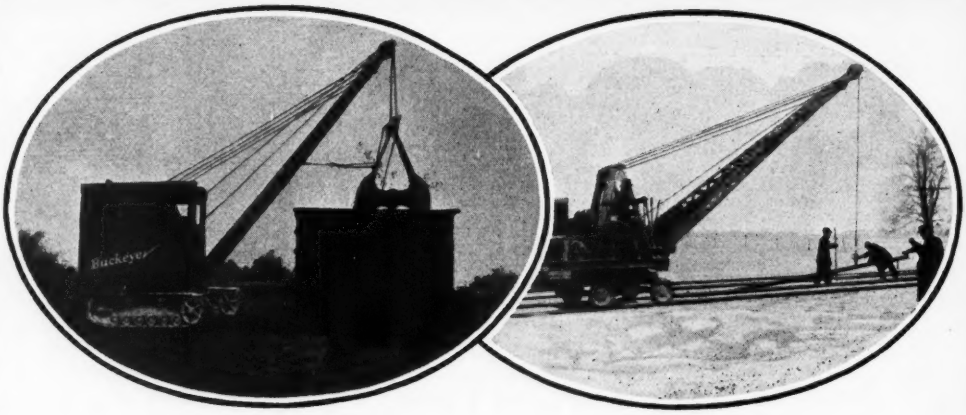
CHICAGO PNEUMATIC TOOL COMPANY

RAILROAD DEPARTMENT

6 East 44th St., New York
1004 Mutual Bldg., Richmond, Va.
Terminal Tower, Cleveland
310 So. Michigan Ave., Chicago
175 First St., San Francisco

C-296

UTILITY



—That's Buckeye!

Rugged construction—the real foundation of reliability and low operating cost—has always characterized Buckeyes.

For compactness, speed and mechanism, compare the Utility Backfiller-Crane, pictured above, with any equipment of its class—regardless of price. Within the range of its ⅜-yard capacity, it is master of its field. Rapid convertibility—without drum lagging—to Clamshell, Dragline, Orange-peel, Backfiller or Crane, multiplies its earning ability.

Consider these distinguishing features—Two speeds for all operations, including traction; Twin Disc Clutch controls; machine-cut gears from solid blanks, heat-treated and hardened; upper and lower bases both one-piece electric steel castings; cable drums mounted on separate shafts; Timken roller bearings; adjustable-length boom; full-circle swing; positive traction brakes for safe grade operation, and Buckeye steel-tread Alligator Crawlers.

Flanged wheels adapt it to operation from main track or from rails laid on flat cars. *Alligator (Crawler) Traction* is for service independent of track.

Write for complete specification and performance data.

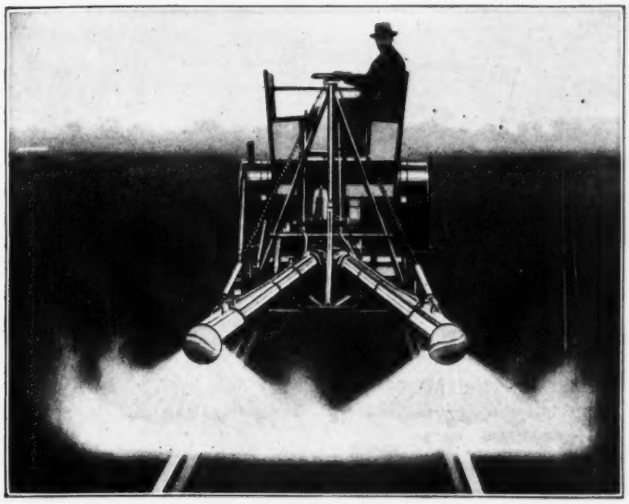
THE BUCKEYE TRACTION DITCHER COMPANY, Findlay, Ohio

There's a Buckeye Sales and Service Office Near You

for over thirty years

Buckeye

The "Midget" *and the* "Giant"



THE MIDGET "OCTOPUS"

New Models of the

WOOLERY "OCTOPUS" LINE

of Railway Weed Burners

THEY do the work of an army of men at one-tenth the cost of hand labor. .:.

The Midget "Octopus"

The Chore Boy of the Rails. Designed for the use of Short Line Railroads, Street Car Companies, Lumber Companies, and for work around the Yards and Terminals of Large Railroads.

The Midget "Octopus" presents a solid wall of flame, 10 feet wide, or its long arms can be set out to burn to a width of 18 feet by making a second trip.

It is easy to handle, quick in action, and most economical in operation. It is a machine that every railroad needs and should have a number of to effectually cope with the weed nuisance.

Write for Special Literature giving details and full information about this versatile little machine.

The Giant "Octopus"

A Woolery Masterpiece. Equipped with either 3 or 5 burners. The 3-burner type presents a solid wall of flame 15 feet wide, or its side arms can be swung out to burn to a width of 30 feet. The 5-burner type presents a solid wall of flame 25 feet wide, or its side arms can be swung out to burn to a width of 35 feet.

Burners may be swung in or out—up or down—at the will of operator at the control crank while the machine is in operation. Each burner is under separate control. No need of fire where there are no weeds. Just a turn of a valve and the fire is out; another turn and it is on again—simple, safe and sure.

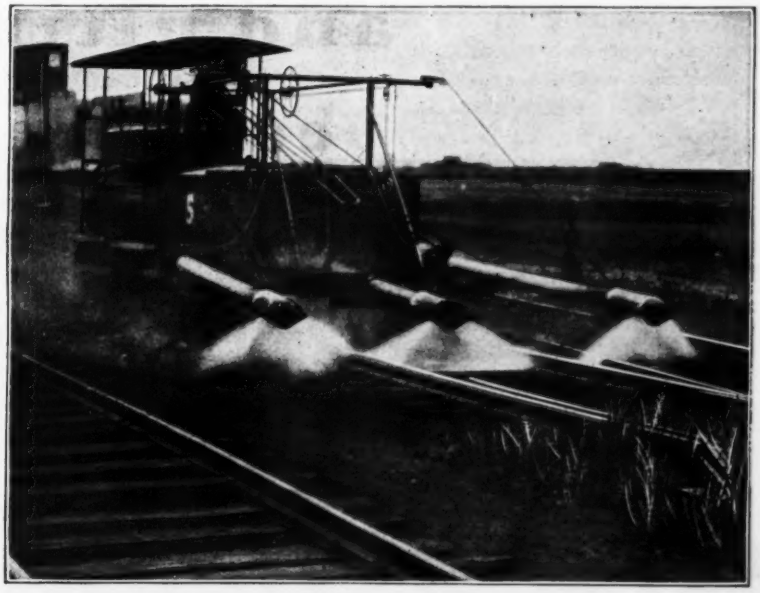
Write for Special Literature giving complete details of this wonderful machine that is solving the weed problem for many railroads.

ATTEND A DEMONSTRATION OR ARRANGE FOR ONE

Railroad Officials who have seen the Woolery "Giant Octopus" in operation are unanimously of the opinion that it is the final word to the railway weed problem. Demonstrations are continually being made. Attend one if possible or arrange for a special demonstration on your railroad.

Note Illustration to Right!

This picture was taken in the Soo Line Yards at Minneapolis, Minn., and shows the Giant "Octopus" in the actual operation of clearing the tracks of weeds and vegetation that in some places had attained a growth of from 8 to 14 inches. The tracks in the foreground show the work well done at a speed of 4 miles per hour.



THE GIANT "OCTOPUS"

WOOLERY MACHINE CO. - Minneapolis, Minn.

For continuous efficiency—good performance—effective results—and ultimate economy, use FAIR Rail Anti-Creepers.

THE P. & M. CO.

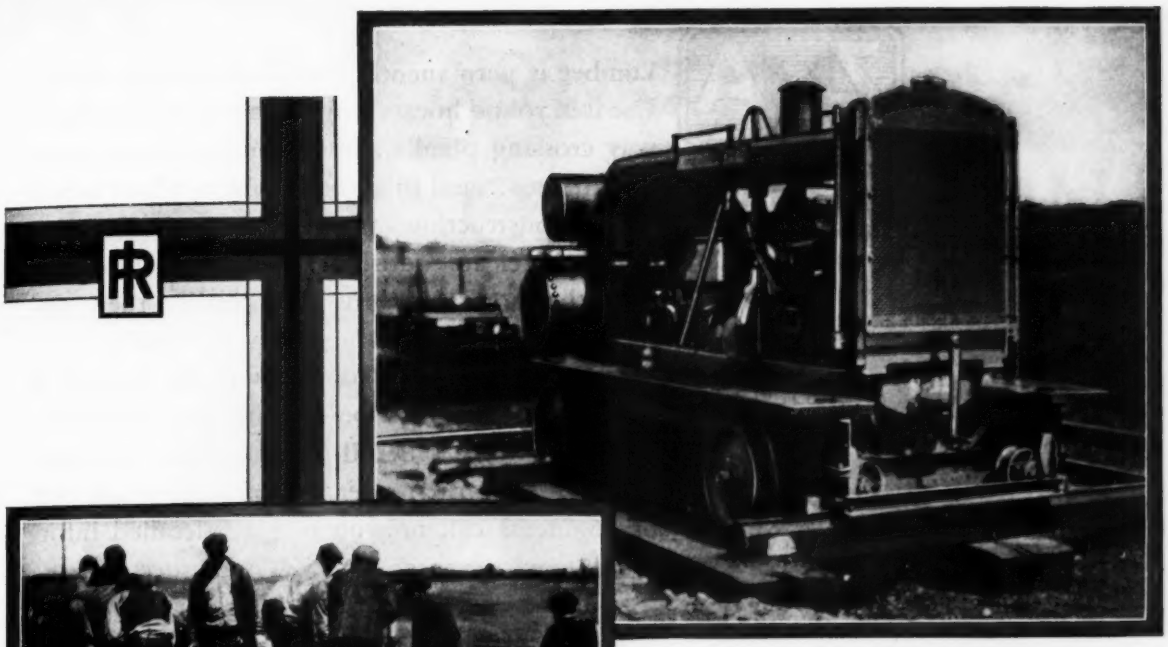
Railway Exchange · Chicago, Ill.

New York Montreal

London Paris

Calcutta Sidney

THE FAIR BRAND RAIL ANTI-CREEPER
Fair is a Trade Mark of and indicates Manufacture Solely by THE P. & M. CO.



Size 10" x 8" Compressor supplying air power for 12 tool pneumatic tamping gang.

Beating last year's records

Reports from many roads show that exceptionally good progress is being made on their ballasting work.

This improved performance is resulting from three factors—refinements in methods, improved character of labor available, and the efficiency of the machines used.

In the latter case, Ingersoll-Rand Pneumatic Tamping outfits are doing their part to bring about faster and better tamping, and to help produce roadbeds that will stand up two to three times longer than those tamped by hand.

INGERSOLL-RAND COMPANY
11 Broadway New York City

Branches or distributors in principal cities the world over.
For Canada Refer—Canadian Ingersoll-Rand Co., Limited,
10 Phillips Square, Montreal, Quebec.

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Ingersoll-Rand

ZMA

Lumber is permanently protected against decay. Use it in round houses, engine terminals and highway crossing planks...in station buildings, snow fences and platforms...and in all other places where wood is the principal construction material.

ZMA lumber is clean, odorless, of natural color and paintable. Furthermore, it burns less readily than untreated lumber.

ZMA lumber can be used in contact with the ground. It is thoroughly protected against both white ants and decay.

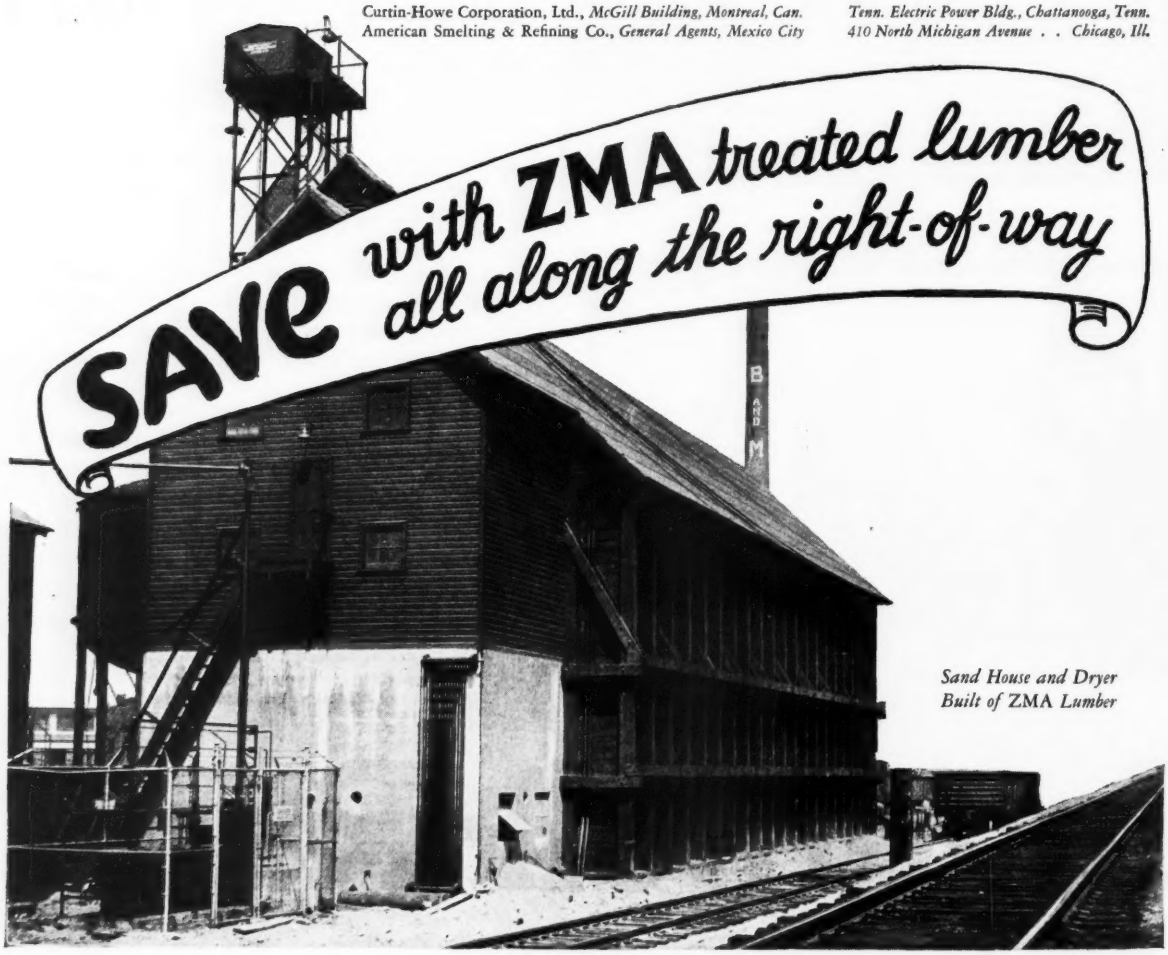
Specify ZMA lumber — the all-purpose, clean pressure treated lumber. Write for further information or ask that one of our engineers call on you to give detailed information of the many advantages of ZMA lumber and the savings to be obtained through its use.

CURTIN-HOWE *Corporation*

TIMBER PRESERVATION ENGINEERS
415 LEXINGTON AVENUE, NEW YORK CITY

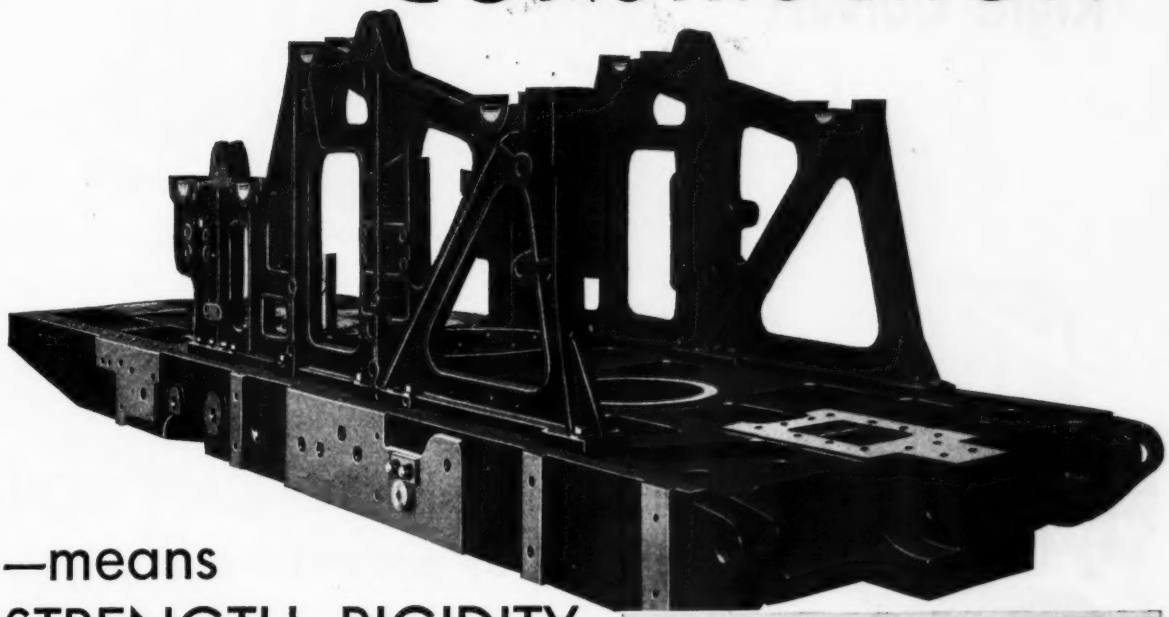
Curtin-Howe Corporation, Ltd., *McGill Building, Montreal, Can.*
American Smelting & Refining Co., *General Agents, Mexico City*
Tenn. Electric Power Bldg., Chattanooga, Tenn.
410 North Michigan Avenue . . Chicago, Ill.

SAVE *with* ZMA *treated lumber all along the right-of-way*



Sand House and Dryer Built of ZMA *Lumber*

UNIT CAST STEEL CONSTRUCTION



—means STRENGTH, RIGIDITY and PERMANENCE of ALIGNMENT

The greatest single factor of support for P & H power is unit cast steel construction. All the main frames of P & H Excavators, including the revolving frame, car body, side stands and side frames of the crawlers, are heavy single-piece steel castings. The engine is mounted directly upon the revolving frame, instead of on structural sills attached to the frame. Shafts and gears are kept in perfect alignment at all times. There is less wear, and maintenance costs are reduced to the minimum.

Shafts are of chrome-manganese steel, extra large and heavy, and those for heavy duty are forged and heat-treated. Gears are extra wide faced, hobbed from steel blanks. All of this sturdy construction explains why P & H Excavators are able to stand up year after year under the tremendous power of their large motors.

HARNISCHFEGER CORPORATION
Established 1884
3820 National Avenue, Milwaukee, Wisconsin
Agents and Offices in Principal Cities
Warehouses and Service Stations:
Hoboken, Memphis, Jacksonville, San Francisco, Los Angeles, Seattle, Dallas

P & H

EXCAVATORS

½ to 4 cu. yds. (A-561)

Vibration may wreck a Rigid Culvert

So flexible culverts of TONCAN IRON are preferred by progressive engineers

RAILROAD equipment is constantly feeling the ill effects of vibration. Designers provide liberal factors of safety to combat it.

The road-bed, too, suffers from the jar and rumble of passing trains. Rigid types of culverts feel these vibrations day in and day out. They resist them and finally crack and crumble, whereas Toncan Iron culverts are flexible—and easily absorb the shocks.

In consequence, the culvert of Toncan Iron lasts far longer. In addition to a favorable structure the Toncan Iron culvert enjoys the unique advantage of a composition that fits it to outlast other metallic culverts.

Toncan Iron has set a new standard in rust and corrosion resistance. Made of refined iron, copper and molybdenum, it has lasting qualities that result in the lowest cost-per-year in the ground—the ultimate cost figure that interests the engineer.

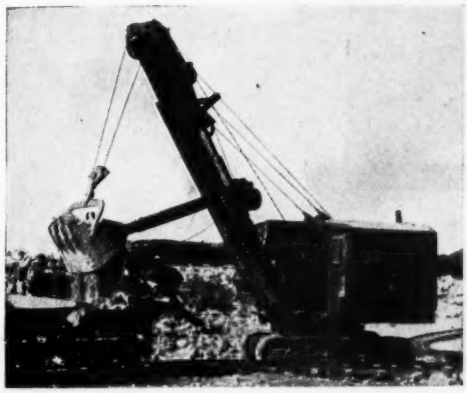
TONCAN CULVERT MANUFACTURERS' ASSOCIATION
MASSILLON, OHIO

Plants located in all parts of the United States and Canada

TONCAN COPPER MO-LYB-DEN-UM IRON

ARE You Paying For an Industrial Brownhoist ~ ~ Without Owning One?

Are you spending thousands of dollars every year on inefficient handling methods—money which could be more profitably applied toward the purchase of a good Crawler or Locomotive Crane? The savings effected by one of these machines would soon pay for it and from then on dividends would quickly pile up.



The Type DC Gas Crawler Crane illustrated is a fast operating, convertible machine of 15 tons capacity. Construction features include two speed hoist, two speed travel, and steering independent of all other motions with any degree of traction on both crawlers, for sharp or gradual curves.

Owners of DC machines will tell you that it is the best crane of its capacity on the market, but it may not be the type best fitted for your work. The nearby Industrial Brownhoist representative can help you decide this point, without prejudice, because we build many sizes of both crawler and locomotive cranes, with gas, steam, Diesel or electric power.

The fact that every Industrial Brownhoist is suited to its work is one reason why there are far more of these cranes in service than any other make.

Industrial Brownhoist Corporation, General Offices, Cleveland, Ohio

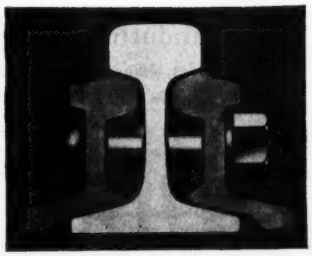
District Offices: New York, Philadelphia, Pittsburgh, Detroit, Chicago, New Orleans, San Francisco, Cleveland.

Plants: Brownhoist Division, Cleveland; Industrial Division, Bay City, Michigan; Elyria Foundry Division, Elyria, Ohio.

INDUSTRIAL BROWNHOIST

RAILS *and* RAIL JOINTS

Correct manufacture and prompt delivery make Carnegie Rails and high carbon, oil quenched Rail Joints your natural preference.



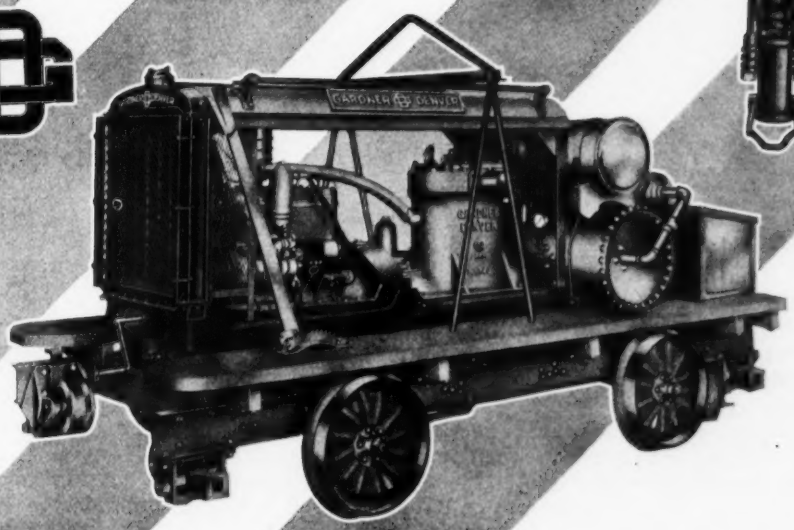
CARNEGIE STEEL COMPANY

Subsidiary of United States Steel Corporation

PITTSBURGH, PA.

69

MODERN COMPRESSED AIR EQUIPMENT



is a necessity in these days of keen competition. GARDNER-DENVER PORTABLE COMPRESSORS—both railroad and standard mountings,—with compressed air drills and industrial tools are reducing costs of construction work, everywhere. We have a service and sales office near you.

GARDNER-DENVER COMPANY

QUINCY, ILL. DENVER, COLO.

Sales Offices Throughout the World

GARDNER-DENVER

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ADDRESS REPLY TO
105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: "Nixies"

July 31, 1930

Dear Reader:
Everywhere

Probably you have never heard of "nixies." I never did either while I was in railway service and it was only after I entered the publishing field that I found that they were of very live concern to an editor.

As a people, we are rapidly becoming nomads, moving from place to place at frequent intervals. The postmaster at Chicago tells me that 42 per cent of the people in this city change their addresses yearly and that the removals in this one city alone exceed 600,000 annually. We are likewise becoming careless in many details, as in advising promptly the publishers of those magazines for which we subscribe whenever we change our addresses. Whenever you move and forget to notify us of your new address and as a result fail to receive the copy of Railway Engineering and Maintenance that is sent you, that copy becomes a "nixie."

We receive approximately 100 requests for change of address monthly, which changes we are glad to make in order that you may continue to receive your magazine regularly and promptly. In an endeavor to ascertain how many of you fail to advise us promptly of your new address I have made a check of the "nixie" notices received from the post office during the last two months and find that they average about five per thousand subscribers. The Chicago postmaster tells me that this is an abnormally low figure and indicates a high reader interest. We have been much pleased with this report, particularly since a large part of the "nixies" are due to the fact that requests for change of address reach us after the stencils for the current month have been run off and copies mailed.

We appreciate your interest in our paper that causes you to advise us so promptly of your changes in address. We look for the day when co-operation in this direction will be universal and "nixies" will entirely disappear.

Yours truly,

Elmer T. Howson

EDITOR.

ETH*MM

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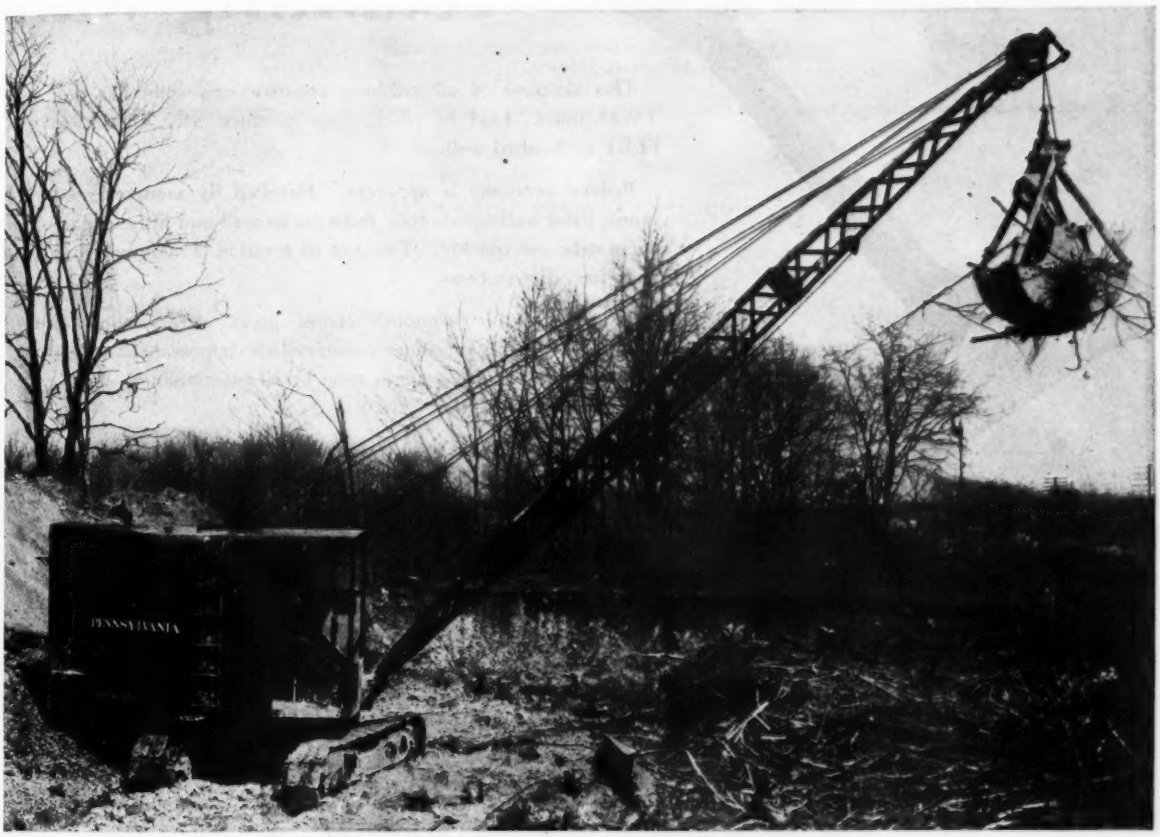

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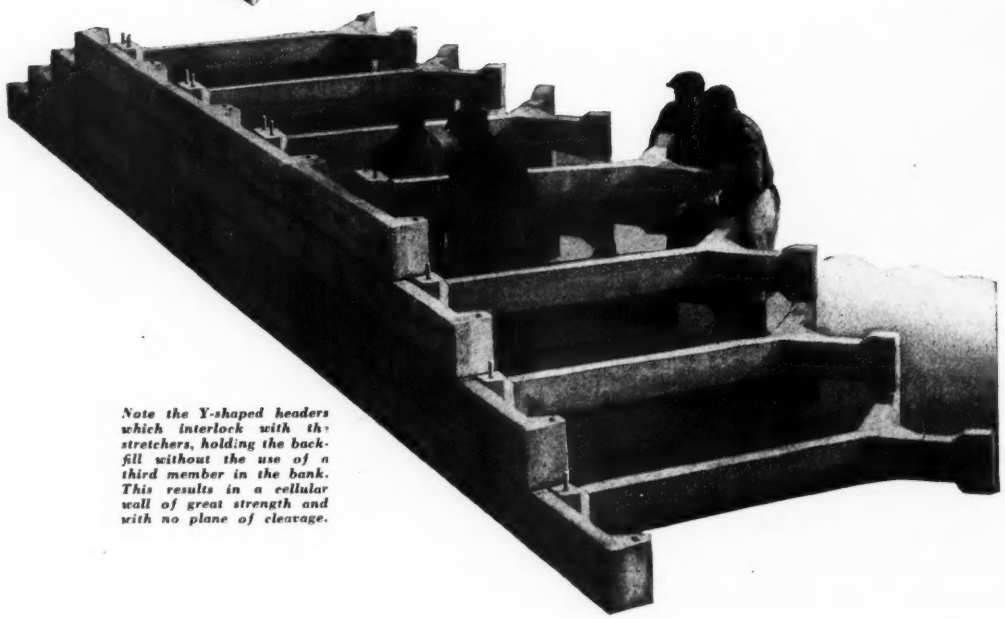

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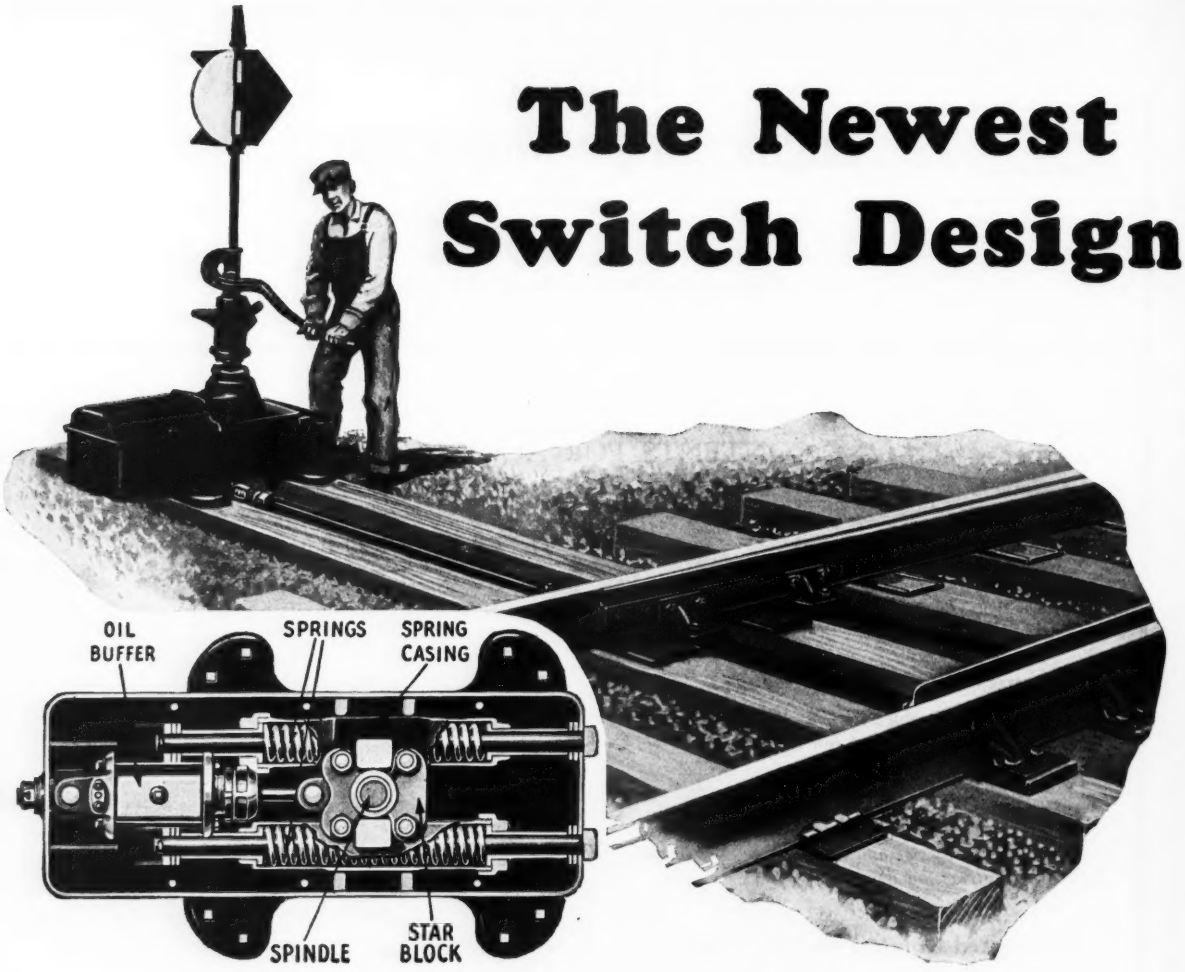

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Railway Engineering and Maintenance

Volume 26 August, 1930 No. 8

A Problem of Selection

THERE HAS never been a time since the beginning of the railways when there has not been more work to be done than the available funds would permit. Railway officers have long been trained, therefore, in the weighing of proposed tasks according to their relative importance or necessity and to the selection for first attention of those projects which are most urgent or which yield the greatest return. The conditions which are now confronting maintenance of way men of all ranks, from chief engineer to foreman, are not new, therefore, except in degree.

For several years the earnings of the roads have been such as to warrant not only such measures as make good the wear and tear of traffic and the elements, but also much work of an improvement character that will contribute to reduced costs of maintenance. In recent months the decline in earnings on most roads has been such as to cause maintenance officers to curtail expenditures severely. This calls for the exercise of a much higher degree of discrimination than has been necessary in late years and makes it necessary to choose most carefully now between those tasks which are essential to the safe and economical movement of traffic and those others which, while important and warranted under normal conditions, contribute less directly to this result. This selection calls for a high order of judgment on the part of chief engineer, supervisor and foreman alike. In fact, it constitutes a practical test of his executive ability for it requires him to depart from his scheduled program of work and to approach the problems which now confront him from a new and more critical angle.

In selecting the tasks to be prosecuted, the maintenance man should have as his first consideration the extent to which each task contributes most directly to the principal work of the railroad—the handling of traffic. To the track man, this places primary emphasis on the riding qualities of the track,—to the bridge man, the safety of his structures, etc. If he must neglect some task customarily performed, this thought should be uppermost in his mind. This year is not one for refinements in maintenance; rather it is one for essentials. Every maintenance officer should constantly check his activities to insure that only those tasks are being performed which measure up to present-day conditions.

Taxes

In the 38 years from 1890 to 1928, inclusive, railway taxes increased 13 times as fast as the population of the country, 6 times as fast as the rate of growth in property investment of the roads, and more than 3 times as fast as net earnings. Between 1911 and 1929, taxes increased 302 per cent, while dividends paid stockholders increased only 23 per cent.

In 1929, taxes absorbed 6.32 cents of every dollar received by the railways, or 22.35 cents of each dollar of net earnings. In this year the railway tax bill amounted to $1,150,000 per day, $47,945 per hour, or $13.32 per second. The tax bill in this year required the net earnings from 54,000 miles of lines, with 372,000 employees, 13,300 locomotives, 521,000 freight cars, 12,000 passenger cars and other facilities in proportion. This indicates the magnitude of the tax drain on the railways, and it is still increasing.

Enforce the Rule

THE derailment of a fast passenger train on the double-track main line of a prominent railway a few weeks ago brought to light a practice which is all too common among maintenance of way forces. In the investigation of this accident, which resulted in the death of two persons and the injury of 12 others, it was found that the train had struck an open switch leading to a crossover, which switch had been opened by a foreman in order that he might move a motor car and trailer through the crossover to the other track. It was developed further that this foreman had instructed a laborer to close and lock the switch and had proceeded down the track without waiting to see that his instructions had been complied with. If this were an isolated case comment would be unnecessary, but accidents from this cause occur with sufficient frequency to demonstrate the necessity for constant vigilance.

In the routine conduct of their work it becomes necessary for maintenance of way forces to transport heavy and bulky materials over their territories. To do this, motor and hand cars must be operated through switches, and foremen are provided with switch keys in order that they may open the switches as necessity arises. Because of the constant hazard of an open switch, however, the book of rules of practically every road place on the foreman the responsibility for the safe operation of the switch when so used and require that it be opened and closed only under his personal supervision. In other words, this is a responsibility which he is not allowed to delegate. Yet accidents continue to happen and when they occur it is found almost invariably that the foreman has left this important task to a subordinate.

The rule with regard to this responsibility is suffi-

ciently explicit to eliminate accidents from this cause, if adhered to. The fact that accidents continue to occur from this source shows that the rule is being disregarded with considerable frequency. As such, it warrants the attention of supervisory officers, for it is safe to assert that for every violation of this rule that results in an accident, there are hundreds that create the same hazard but are not detected. The only sure way to avoid an accident from this source is to require universal compliance with the rule at all times and under all conditions.

Polluted Water

THE importance of guarding against water-borne diseases is now so thoroughly recognized that most cities provide their residents with safe drinking water. Unfortunately, the essential facts concerning the spread of enteric diseases through the agency of bacteria transported by water were not fully understood until the practice of dumping raw sewage into streams and lakes had become so thoroughly established that the financial, technical and legal obstacles confronting efforts to correct this evil are almost insurmountable. As a result engineers of water supply meet difficult problems in their efforts to provide potable water.

Polluted water is not solely a source of difficulty in cases where water is needed for domestic use. It introduces serious problems also when it is the most available supply for consumption in boilers. Certain industrial wastes are often the source of boiler troubles, and in some cases, as in the one described on page 336 of this issue, are of a nature that defies correction by treatment. Court decisions in certain test cases indicate a definite tendency to place considerable weight on the rights of the user of water from flowing streams, but it will obviously be many years before such rights will be established so thoroughly that all stream pollution will be prevented. In the meantime, those charged with the responsibility of providing suitable water for railway use may well exert their influence in arousing popular disapproval of the contamination of streams.

Do You Know Where Your Section Foremen Live?

THERE ARE few occupations in which it is more important that a man live near his job or in close communication with it, than that of a section foreman. The very nature of a foreman's work, which places on him the full responsibility of meeting emergencies on his territory that require prompt action, makes it imperative that he be within easy reach by telephone and close to his work at all hours of the day or night.

That this necessity is recognized generally is evidenced by the fact that many foremen voluntarily live in close touch with their sections and by the location of the company-owned foremen's houses which are provided by many roads. That there are exceptions to this practice, however, is equally evident from cases which are brought to light from time to time, usually by the failure to get prompt action with respect to some accident or other emergency call because the foreman was not on the job or readily available. Only recently in a densely settled suburban section adjacent to New York, a serious break occurred in a rail under an early morning milk train. The train passed over the break without leaving the track, but, although it was only necessary to change out a single rail, following commuter trains were delayed for as long as an hour and a half.

Surprising as it was to the maintenance officers of the road in question, on which foremen are supposed to live on their sections, the excessive delay to the commuter trains was due directly to the fact that the foreman in charge of the territory on which the accident occurred lived several miles from his section and from the men in his gang, and was without a telephone. While the local supervisor pointed out that this condition was the result of a shift in section limits a couple years ago, he admitted that there were other foremen on his territory who did not live on their sections and who were not within reach by telephone. He stated further that on several occasions, rather than lose time in locating one of these foremen, he had collected a group of trackmen and handled emergency matters himself, which action, while commendatory, did not excuse him for not insisting that his foremen accept their responsibility and live on their sections. Surprising too is the fact that this condition prevailed without the knowledge of the division engineer, who assumed that all of his foremen lived on their sections, in accordance with instructions.

Investigation would, no doubt, disclose other cases on this road where foremen are not living close to their work, and many such cases on other roads. Even if it required a thorough check from time to time to avoid this condition, it seems that this action would be preferable, from the standpoint of both the foremen and supervisory maintenance officers, to constantly running the risk of delays to traffic caused by inability to get foremen on the job quickly when the necessity arises.

Importance of Rail Branding

AS DATA accumulate from various sources, there is increasing evidence that transverse fissures in rail occur in groups which are confined to certain heats. For this reason it is almost a universal practice to remove from the main tracks all of the rails of those heats which show a tendency to develop transverse fissures. The difficulty of locating these rails may be very great, particularly if they are widely scattered. For this reason some roads make a definite record of the locations of all rails by heat numbers as they are laid. Others endeavor to lay them in groups by heat numbers. Both of these plans have definite limitations: the first because of the amount of clerical work involved; the second because one or more rails may be withdrawn temporarily from any heat for further inspection, straightening or other purposes, and later mixed with rails of other heats before they leave the mill.

In any event, it is obviously of the utmost importance to be able to identify the rails individually at any time during their service life. In order that this may be done, the rails are branded on one side of the web as they are rolled, and the heat numbers and other pertinent information are stamped on the opposite side of the web. Elsewhere in this issue is given a table which shows and explains in detail the systems of branding and stamping rails at 10 American rail mills. Since every mark has a definite meaning and is necessary to complete the identifica-

tion of the rail, maintenance men whose duties require them to report or handle reports of failed rails should familarize themselves with these brand markings and should know the significance of every character that is included.

Why This Expense?

AT THE PRESENT time the demand for maximum economy in the conduct of maintenance of way operations is so pressing, a reader inquires why so many railways continue to space their ties when laying rail when so many other equally well maintained roads have demonstrated to their own satisfaction that this is an unnecessary expense, if not an actual detriment. While this subject was one of live controversy ten or more years ago, less has been heard of it in recent years. Yet a survey will show that while the number of roads that eliminate this expense is growing, this trend is slow and the practice is still far from universal.

The number of roads which have discontinued the respacing of ties is sufficiently large and they have followed this practice for a long enough period to afford ample evidence of the fact that the practice need not be detrimental either to the rail or to the riding condition of the track. Furthermore, recent years have seen the tracks of the country and particularly those on main lines where rail renewal is most frequent, brought to the highest standards ever attained, a fact which lessens the hazard of injury to the rail, even as compared with that prevailing when the roads adopted this practice many years ago.

With the records now available of satisfactory service of rail laid without the respacing of ties as long as ten years ago and with the markedly better general maintenance conditions prevailing today and with the further pressing necessity for eliminating all unnecessary expense it would appear opportune for those roads which still go to the expense of respacing ties to again study the subject in the light of the information now available.

Which Constitutes Economy?

MORE AND MORE, engineering officers are keeping cost records of the work that they do, and this is as it should be. This practice sometimes gives rise to controversies, however, between the man who prepares the plans and the man who executes them in the field. These differences are often based on the fact that the magnitude of the unit prices is taken as the measure of the efficiency of the maintenance organization which handles the work. Taking concrete structures as an example, the designer essays to keep the volume of concrete at a minimum on the ground that by doing this he is developing an economical design. On the other hand, the field man usually is able, within well defined limits, to lower his unit costs as the volume of concrete in the structure increases, and for this reason insists that a heavier design would be more advantageous.

A well founded complaint that is sometimes made by the field forces is that the difficulty experienced in preparing the forms for thin sections, irregular surfaces or "fancy" designs increases the cost per yard of concrete placed out of proportion to the saving in yardage. A recent example of this is the case of a concrete approach to a long steel viaduct, which was designed as a series of short arches, both longitudinally and transversely. The forms were so complicated that when they were completed they alone had cost per yard of the concrete to be placed, two and one-half times the total cost of forms and concrete in the substructure for the steel spans. Unfortunately, the viaduct was on a skew so that a different set of forms, equally costly, was required for the other approach. In this instance a flat slab construction would have been equally suitable and would have cost about the same per yard as the piers, which were of the open type in which the sections had been kept to a minimum.

There is a middle ground which is generally occupied by designers who have had field experience, and who are, therefore, familiar with some of the difficulties which the field man must overcome. Men with this experience are more apt to base their designs on a low cost for the structure as a whole, than to claim economy because they have restricted the yardage of concrete to an irreducible minimum. One engineer requires the men who prepare the plans, whether for a new structure or the repair or alteration of an old one, to go into the field and take charge of the work. Since this practice was instituted, all controversy over plans has ceased and there has been a marked reduction in the cost of his work.

"Trackman" Instead of "Laborer"

FOR YEARS the great majority of the men engaged in track work in both the construction and maintenance of way departments of the railways were unschooled and unskilled and were appropriately termed track laborers, but today, with the extensive changes which have come in track practices and methods, and, to a large extent, in the character and ability of the men employed in this class of work, that term is no longer wholly appropriate or accurate. Modern track work, machinized as it has already become in its many phases and with the continued refinements in that direction and a demand for economy unthought of a few years ago, is requiring both intelligence and skill of the men employed in it. In view of this trend it would appear that the appropriate term for the men now employed in this class of work is "trackmen."

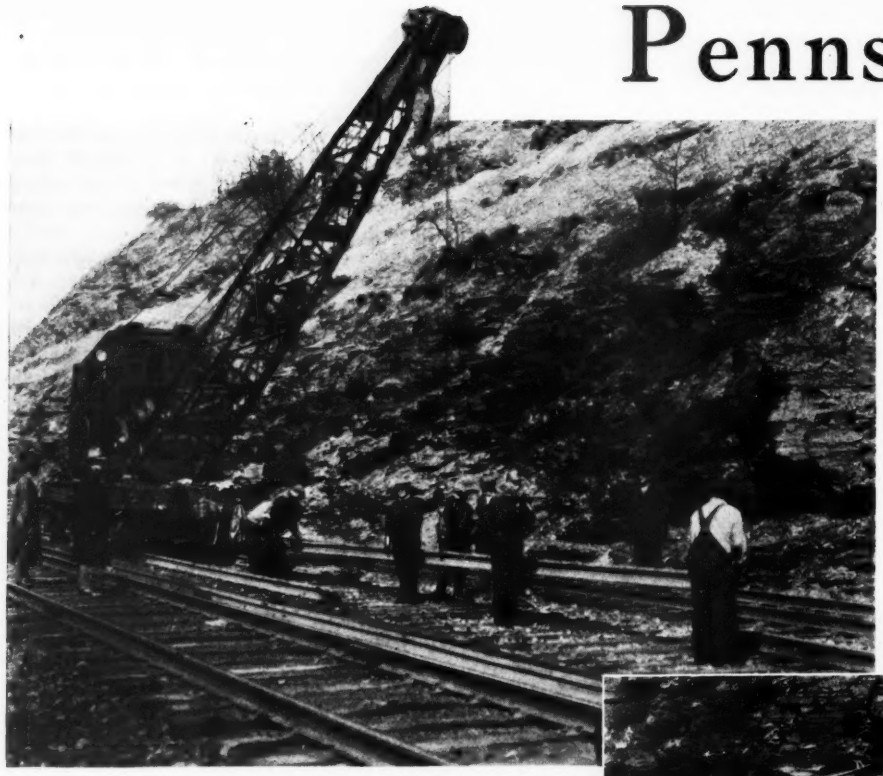
The day of the old-fashioned laborer on the track is rapidly passing, and the term laborer, as generally thought of in this connection, should give way to the more appropriate and accurate term, "trackman." The maintenance of modern track is no longer a problem for men of the intelligence and type found in the ranks of common labor. Strength and physical fitness are still essentials of the man on the track, but in most classes of track work today, these qualifications must be supplemented by a practical mechanical mind plus a high degree of common sense and some schooling. Recognizing this, many roads are picking men for their track forces as they have never done before. They are paying better wages, training their men, offering better working conditions and, justly so, are expecting more from those employed. The average maintenance man today has to be a specialist in track work and, as such, should no more rate the title of laborer than men in the signal, bridge and building, and water service departments, who have long since discarded the title of laborer for those of signalman, bridgeman, carpenter, and water service man, to their own benefit and that of the railways.

While most men are more concerned about their pay than about their titles, a proper title has a stimulating effect which should not be overlooked.

Pennsylvania *Division*

By C. W. ROBINSON

Assistant Supervisor,
Pennsylvania,
Buffalo, N. Y.



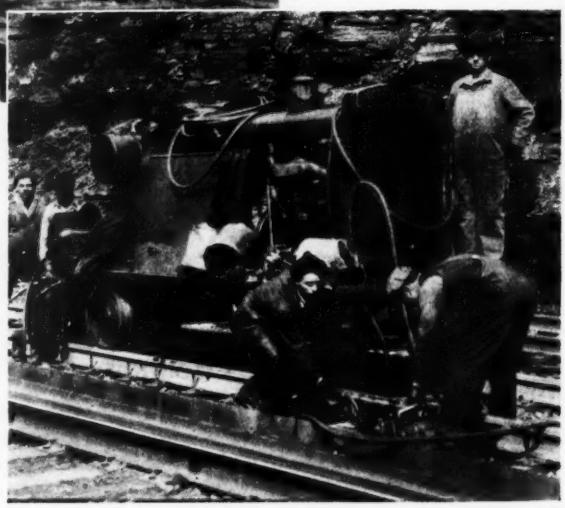
Laying Rail on the Pittsburgh Division

FOR THE 1930 program of rail laying, a number of divisions on the Central region of the Pennsylvania have adopted a form of extra-gang organization and procedure which departs widely in both scope and method from practices heretofore followed on this road. With the purpose of relieving the subdivisions of all duties in connection with rail-laying operations, to the advantage of other maintenance work required of them, and in order to form an efficient rail-laying unit with a greater degree of co-ordination and also to avoid a duplication of expenditure in rail-laying equipment, two rail-laying outfits, equipped with rail-laying machines and tools of the most modern design, have been organized to operate over a large territory.

One of these units was organized to operate over the Pittsburgh division and the other to operate over the entire Eastern Ohio General division, which comprises the Eastern, Panhandle and Wheeling divisions. Formerly rail renewals made in these territories were completed individually by each subdivision, thus requiring a duplication of rail-laying machinery and a loss in efficiency because of the fact that laying rail constituted only one of the many jobs required of the subdivision organization. A frequent break into the normal routine of the subdivision work program was also involved and, in addition, the subdivision gangs are not trained to lay rail and there is a lack of co-ordination and efficiency when they are called upon to do so.

On the Eastern Ohio General Division

The gang on the Eastern Ohio General division was organized for the purpose of completing all rail renewal jobs for the year that were of sufficient size to admit economical use of the gang over the whole general division. These include siding and yard track renewals, as well as those in main tracks.



Short Lengths of Hose on the Bolters in Front of the Compressor Were Found to Eliminate Tangling Troubles

The personnel of this gang consists of one general foreman, two foremen, a crane operator, two compressor operators and 55 laborers. The foremen and operators' jobs were put up for bid over the general division; while the laborers' jobs were bid over the various divisions, each division being requested to supply a quota of men based on its total force.

The equipment of this gang consists of two camp cars for living quarters, a light rail-laying crane, a power rail layer, two air compressors to operate two spike pullers, two bolting machines and two spike drivers, a power drill, one push truck, hose with connections and a set of track tools. Additional equipment, consisting of dollies, track cars for transporting the gang to and from work, fuel and an additional push truck, are furnished by the subdivision on which the job is in progress.

Organizes

Extra Gangs

Scope of rail-laying gangs was broadened to increase their efficiency and avoid duplication of equipment

Gasoline Tractor Cranes Are Used to Pick Up as Well as to Unload Rail on the Pittsburgh Division

Before the arrival of the gang, the supervisor on whose subdivision the rail is to be laid, distributes the new rail, fittings and material, and constructs timber cribs for clearing the machines if a side track or siding is not convenient. The gang is transported to the subdivision overnight or on Sunday and the camp cars and equipment are located at the most convenient point in the vicinity of the job. The machines are unloaded on the cribs by the subdivision work train and transferred from point to point by it when necessary. The half-hour lunch period is generally omitted and the men eat while working, unless there is an opportunity to eat while the work is held up by traffic.

The Gang Organization

During the period between February 25 and March 1, this gang worked on the westbound freight track west of Canton, Ohio, relaying 100-lb. Pennsylvania section rail with 130-lb. rail of the same section. Rail was laid on one side of the track at a time and the ties were in good shape, requiring very little adzing. A few men were off because of sickness and one spike puller was in the shop.

On this territory the gang was organized in the following manner: One man ahead knocking off rail anchors; one man pulling joint spikes; five men pulling outside spikes; truck with gasoline and tools; first compressor with two men operating one spike puller; welder and helper cutting all bolts; two men barring out old rail; one man removing old tie plates; one man setting tie plugs; one man driving plugs; one man adzing ties; one man setting new plates; rail-laying crane with two men handling rail and one man assisting with bar; seven men gaging track and starting spikes; two men setting up joint bars and starting bolts; second compressor with four men operating two bolters; two spike drivers, one man to each; one man putting on rail anchors; one man following to redrive bad spikes; one flagman; and one water boy. The gang arrived on the job at 11 a. m. on February 25 and by noon, March 1, had completed laying all the rails in this stretch, which amounted to 386 rails or 291 tons in all.

During March 4 and 5, at Bellevue, Pa., the track was turned over to the gang practically to use at will and the subdivision work train equipment worked in conjunction with the gang. In this instance operations were confined to main track No. 3 and both rails were laid in one operation, rail of 130-lb. Pennsylvania section being relaid with rail of the same weight and section.

The organization of the gang at this location was as follows: Subdivision work train distributing material; two men knocking off rail anchors; four men raising inside spikes; welder and one man cutting bolts on every fifth or sixth joint; four men barring out rail; first compressor with two spike pullers with two men to each puller; rail-laying crane with five men handling rail and driving spikes for passage of crane; eight men setting up spikes; second compressor with two bolters, with four men to each bolter, and two spike drivers; two men putting on rail anchors; six or eight men unbolting old rail; locomotive crane with four cars loading rail; locomotive crane with two cars and four men loading joint bars and scrap; and one water boy.

On March 4 the gang laid 309 rails or 233 tons. On March 5 about three-quarters of an hour was required to set up the machinery and track was broken at 9:15 a. m. No time was taken for lunch and the track was closed at 3:30 p. m. with 348 rails or 263 tons laid. This averages close to 56 rails per hour for the time actually spent in laying rail, and for the total of 48 men, including the crane and compressor operators and water boy, actually engaged in laying rail, an average of seven rails per man for the day.

The hose used on the bolters, which was 50 ft., was too long and required a man for each bolter to handle the hose. With 25 ft. of hose or an even shorter length for the near bolter and with the compressor following close, the two machines can work together without a man to keep the hose from tangling.

On the Pittsburgh Division

The gang which was organized to operate on the Pittsburgh division is similar in most respects to the one just described. This gang was to lay all new main-track rail on the Pittsburgh division and proceeded from east to west. Each subdivision was expected to have any frog and switch renewals in its

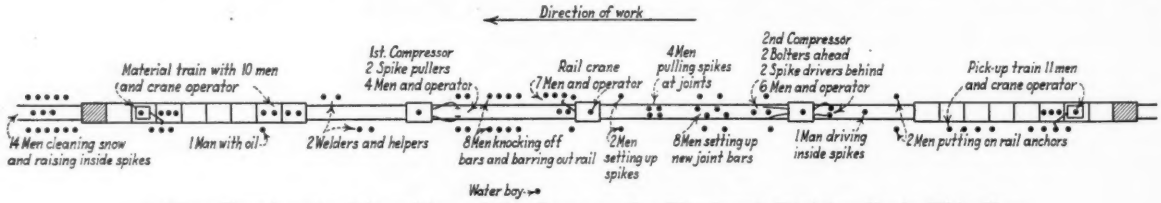
new rail territory completed before the gang arrived.

The personnel of this gang is the same as that one on the Eastern Ohio General division except that two assistant foremen and two crane operators have been added. The laborers number 56 and were recruited by reducing the force on each subdivision by 10 men and offering these men positions on the rail gang.

The equipment also varies somewhat from that of the previous gang. An eight-ton, gasoline rail-laying crane was substituted for the light rail-laying crane and the power rail layer, and two gasoline tractor cranes are used in connection with the unloading and loading of rail. The equipment of the previous gang was otherwise augmented by the addition of a spike puller, an air bolter and a spike driver.

Early in the year it was necessary for 14 men to clean snow from the track and to pull inside spikes ahead of the major portion of the gang. These men were followed by the material train on which the engine was followed by drop-end gondolas through which the crane operated in unloading the rail with the help of six men. Next in the work train came a car of joint bars and two cars of material with four men unloading joints and other material.

The remainder of the gang was organized as follows: One man swabbing rail ends with black oil; two welders and helpers cutting all bolts; first compressor with two spike pullers, two men to each puller; eight men knocking off joint bars, pulling remaining spikes, barring out rail and cleaning off scrap; the rail crane with three men handling rail, two men assisting with bars and two men setting shims and driving spikes for the crane; two men setting outside spikes; four men pulling inside spikes at new joints; eight men setting up joint bars and starting nuts; second compressor with two bolters, with two men to each bolter, and two spike drivers with one man to each driver; one man driving inside spikes; and two men putting on rail anchors. A clean-up train brought up the rear, consisting of flat cars containing tools and fuel and on which the compressors were loaded; drop-end gondolas through which a crane operated in loading rail; and gondolas for loading fit and scrap material, with one man turning up the old rail; three men on the ground and three in the cars handling rail; four men loading joint bars and scrap; and one water boy.


Direction of work
Material train with 10 men and crane operator
1st. Compressor 2 Spike pullers 4 Men and operator
Rail crane 7 Men and operator
4 Men pulling spikes at joints
2nd Compressor 2 Bolters ahead 2 Spike drivers behind 6 Men and operator
Pick-up train 11 men and crane operator
14 Men cleaning snow and raising inside spikes
1 Man with oil
2 Welders and helpers
8 Men knocking off bars and barring out rail
2 Men setting up spikes
8 Men setting up new joint bars
1 Man driving inside spikes
2 Men putting on rail anchors
Water boy

A Plan Showing the Disposition of the Gang on the Pittsburgh Division Early This Year

On March 4 rail was laid west of Donohoe, Pa., in main track No. 2. Track was broken at 9:45 a. m. and was closed at 4:40 p. m. with 395 rails or 298 tons laid. No time was taken for lunch. There were 62 men actually engaged in the rail laying, including the crane and compressor operators and four men cleaning snow. This gives an average of about 6½ rails per man for the day and for the total of 6 hr. 55 min. engaged in rail laying, an average of 60 rails per hour.

The bolting machines are handled much more efficiently than on the Eastern division. With a shorter length of hose and the compressor closing up directly behind them, they are able to cross from side to side without confusion, one machine tightening the three bolts on the north side of each joint, the second following and tightening the three bolts on the south side of each joint. While the Eastern division uses a third man to drive the head of the bolt, one of the operators of each bolter on the Pittsburgh division drives the bolt and manipulates his handle of the machine with the other hand, the second man controlling his handle and operating the valve.

Some Observations

On the Pittsburgh division, the rail is cut at every joint and barred out to the edge of the ties. The rail crane then moves the old rail on one side of the track to the opposite side to facilitate subsequent loading. The power rail layer, which does not require a crib on which to be set off, is carried with the gang on the Eastern division for use in case the light rail-laying crane is disabled. The heavy rail-laying crane, which is used on the Pittsburgh division weighs approximately eight tons, is equipped with a 40-ft. boom and works somewhat smoother and easier than the light rail-laying crane. It is much too heavy to clear by setting off on cribs and, therefore, the track must be obtained for the entire day for its use.

Two men are required to operate the spike pullers as the operation is too strenuous to work one man speedily for a long period of time. One man operates the tool while the other handles the hose and they relieve each other frequently. One spike puller pulls 54 or more spikes in five minutes and a man follows the two spike pullers and pulls the spikes missed by them. About one in ten are left unpulled for no time is wasted over a spike that does not come all the way with the upward stroke of the piston, although the spikes left unpulled were always started sufficiently to make their removal an easy job for the clawbar. Two spike pullers are sufficient to keep the job going when renewing rail with the same section, but four are necessary to pull all the rail-holding spikes when renewing 100-lb. rail with 130-lb. rail, if both sides are laid at the same time.

The bolting machines are used most efficiently ahead of the second compressor. Fifty-five seconds is sufficient to bolt one six-hole joint up tight. The chuck of the bolter is too large to remove bolts in continuous joint bars, as it gets stuck between the nuts and the base of the bar. A clamp used in connection with the setting up of the joint bars was thrown momentarily over the two bars after they had been set in place in order to hold them tight against the rail until two of the nuts could be started.

This is the first year that rail laying on such a scale has been in effect on the Pennsylvania. There are naturally several details in the operation of these gangs that will be improved as time passes. Already, subsequent to the date these observations were made, the average performance of the gangs has increased considerably over that noted in this article.

Ninety-five Years of Rail on the Boston & Maine*

Growth in size and weight from 1834 *to* 1929 *is shown in interesting diagram*

THE Boston & Maine now has on exhibition in the concourse of its new North Station in Boston, Mass., a length of the old "fish-belly" rail, or elliptical rail as it was known in England, which was laid in 1834 on the Boston & Lowell, now a part of the Boston & Maine. The rail is set in the original chairs, mounted on the original stone ties. This rail weighs 33 lb. to the yard, and presents an interesting contrast to the 130-lb. rail which the Boston & Maine is now using in its important lines, a length of which, together with its heavy joint, canted tie plates and other fittings, is displayed alongside of the pioneer rail. The majority of the fish-belly rails were 15 ft. long, although they were also made in 12-ft. and 18-ft. lengths.

Method of Using Fish-Belly Rail

The fish-belly rail was the first wrought-iron rail and was patented in England by Birkenshaw in 1820, where it quickly took the place of cast-iron rails, which were only three feet long and subject to excessive breakage. In track the fish-belly rails were supported on cast-iron chairs resting on stone blocks and stone ties, spaced three feet apart center to center. The following "manner in which the rails are supported" is taken from the sixth annual report of the Boston & Lowell Railroad Corporation dated January 3, 1838:

"The foundation for the first track of rails is laid with dry stone walls in trenches from 2½ to 4 ft. deep and about 18 in. thick.

"The rails are laid part on stone blocks, part on stone blocks and sleepers, and a small part on stone blocks and wooden sleepers, all of which are supported on the trench walls above described.

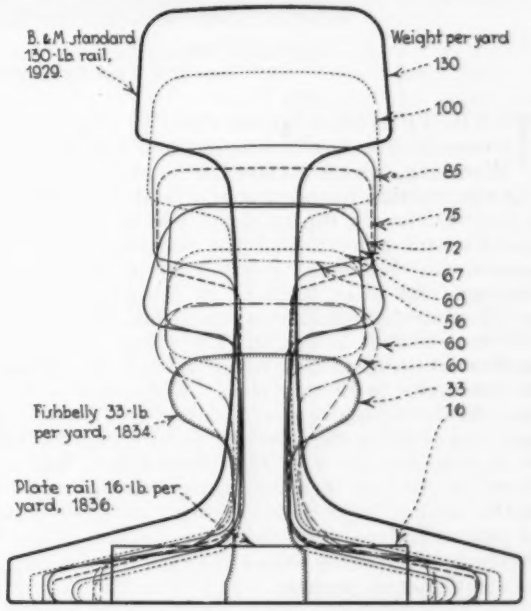
"The stone blocks are 3 to 4 cu. ft. each. The stone sleepers are 7 ft. long and average 8 in. by 10. in. square. The wooden sleepers, of chestnut and white cedar, are 7 ft. long and 7 to 8 in. in diameter.

"This track is laid with rails of the fish-belly pattern, and is set on chairs which are fastened on to the blocks and sleepers above described.

"The second track is laid for about three miles in the same manner as the first one is; the remaining 8-1/3 miles is laid mostly on stone sleepers (some few blocks intervening) which are supported on a bed of clean gravel 7½ in. wide and 2½ to 3 in. deep."

In the use of fish-belly rail there were no bolts through the rail nor any so-called fish bars. Four holes, 4½ in. deep, were drilled in each stone tie or block to correspond with the holes in the iron chair. The holes were plugged with hardwood pins into which the spikes were driven. As the wood decayed it was necessary to dig it out and replace it with wood that would hold the spikes. Many of the stone ties, being center bound in the ballast, broke in the middle during the winter. Tie rods were installed in various places in the line to preserve gage.

When the stone ties were first installed, it was planned to keep them to surface by tamping, as with wooden ties. However, the labor was so great that it became the practice to leave the stone ties embedded and to maintain surface by inserting wooden shims of the required thickness between the tie and the base of the rail, as had been done with the blocks.



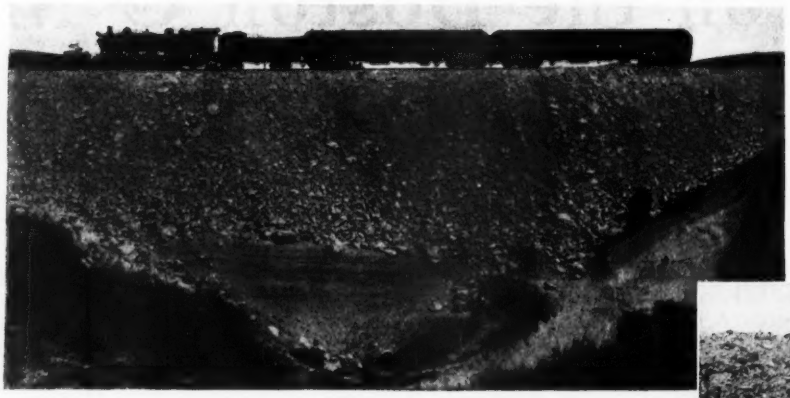
The History of Rail on the Boston & Maine at a Glance

About 1870 the use of wooden ties was introduced by the Boston & Lowell Railroad, laying them between the stone ties, and by 1878 the line was entirely on wooden ties. Later, wherever possible, the track was raised and the stone ties buried; otherwise they were dug out and used in small masonry jobs. The invention of the T-rail was followed quickly by its general adoption, and the fish-belly rail and the stone tie fell into disuse altogether.

On the Boston & Maine the weight of rail has steadily increased from the 33-lb. fish-belly rail. The earlier sections varied in weight per yard, the more common weights being 56-lb., 60-lb., 67-lb., 72-lb., and 75-lb. For several years prior to 1928 all rail purchases had been in 85 and 100-lb. weights. The 130-lb. rail, except for a small tonnage of experimental rail received in 1928, was introduced last year, and is being laid on the Fitchburg division main line.

*Abstracted from an article written by John J. Kiley, office assistant in the engineering department of the Boston & Maine, and published in the Boston & Maine Employees' Magazine.

Corrugated Metal



An 82-ft. Fill on the New Line—Note 60-in. Culvert in Hollow and Two Distinct Classes of Filling Material

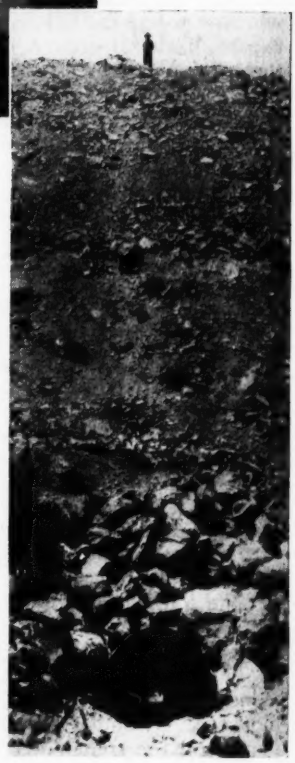
IN EIGHT months' time in 1928, the Union Pacific constructed a 53-mile single track line in eastern Wyoming, which involved a number of interesting construction features, possibly the most interesting of which was the extended use made of corrugated metal culvert pipe for waterways and hog passes. In this work, about 9,100 ft. of this pipe, ranging from 15 in. to 60 in. in diameter, was used in 157 separate installations, under fills ranging from 0.83 ft. to 95.89 ft. in height. Little mention has been made to the present time of the construction features in connection with this work, particularly with regard to the extensive use of corrugated metal pipe, awaiting proof of the advisability of using this class of pipe under the high fills encountered, but it is now pointed out that the corrugated pipe was installed with a large initial saving over other classes of pipe considered, and that investigation of the individual underpasses shows them to be standing up in a satisfactory manner.

Line Penetrates Rough Country

The new line, which extends in a general north and south direction, connects the west end of a branch line of the Union Pacific extending from North Platte, Neb., to South Torrington, Wyo., with the main line of the Union Pacific, about one mile east of Egbert, Wyo., and 198 miles west of North Platte. This line, which is known as the North Platte cut-off, because it provides a direct outlet to the south and west for the crops raised in southeastern Wyoming and western Nebraska without back haul through North Platte, is proving of large benefit to the territory served and also to the railroad from an operating standpoint.

The first 15 miles of the new line from its northern terminus at Creighton, Wyo., passes through comparatively level farming land, part of which is irrigated and produces large crops. For the next 15 miles the line passes through rolling and broken country and increases steadily in altitude until at a point about 29 miles from Creighton it is approximately 1,000 ft. higher than at the beginning of the line. For the remaining 23 miles the line descends through rolling country to an elevation at Egbert approximately 900 ft. higher than at Creighton.

Little difficulty was encountered in the construction work at the ends of the line, but considerable difficulty was encountered throughout about five miles of broken rugged country in the central portion of the line. Within this territory it was necessary to make a number of deep cuts, ranging in depth up to 71 ft., and to construct several fills up to 96 ft. in height. In addition, a 565-ft. single-track tunnel was necessary in order to avoid a larger expense for the construction of a long highway bridge at a considerable height above the right-of-way.



A 60-in. Pipe Under a 95-ft. Rock Fill

Construction on the new line was started early in March, 1928, as soon as the ground had thawed sufficiently to permit grading, and every effort was made to push the work in order that it could be completed in time for moving the 1928 crop. Work was started simultaneously at the two ends of the line and progressed toward the center, construction materials being moved forward by rail as the embankments were completed. Practically all of the grading was accomplished with gasoline and steam shovels and motor trucks, which dumped over the ends of the fills in carrying the embankments forward. Narrow-gage equipment was used on only a small part of the work, particularly in the vicinity of the tunnel. The new line has a maximum ruling grade of 1.25 per cent and maximum curvature of 7 deg. Altogether, about 750,000 cu. yd. of excavation and about 1,500,000 cu. yd. of fill were required in its construction. In the more rugged section, a large part of the cutting was through soft sandstone, requiring blasting. The line was put in service in November, 1928, as

Culverts

Expedite Building of New Line

Large diameter pipe is transported and placed economically under high rock fills on North Platte cut-off of the Union Pacific

scheduled, in plenty of time to move a large part of the 1928 crop.

In order to complete the line in eight months and at the same time to secure substantial and economical construction, much consideration was given at the outset to the selection of materials. One of the outstanding problems was how to provide for the numerous waterways and hog and cattle passes which would be necessary under the new line, and which had to be built in advance of the general construction if the rapid progress desired was to be accomplished. Culvert pipe was recognized as suitable for hog passes and practically all of the waterways necessary under the line, but, owing to the large herds of range cattle in this territory, small pile trestles were decided on for cattle passes.

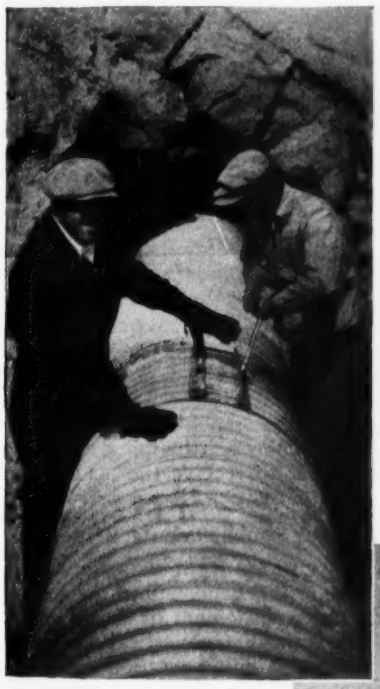
In deciding the hog-pass and waterway problem, which was recognized as one of pipe construction, the factors of utility and of speed and economy of installation were given the most careful consideration. Transportation of the pipe was a most serious problem. This was greatly complicated by the long haul to the section of the line involving the heaviest construction and by the condition of the roads throughout the territory of the work, which were little more than trails in many instances. A further complication was the fact that many of the waterway and underpass locations were inaccessible to trucks.

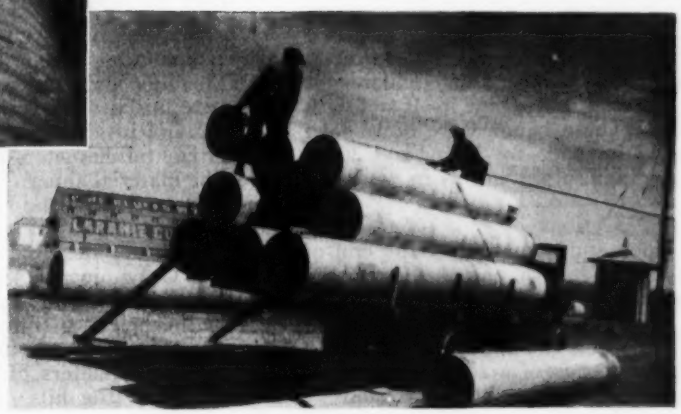
Heavy-gage corrugated metal pipe was specified for the culvert and underpass installations, primarily on the basis of the speed and economy with which it could be hauled and installed under the conditions presented. Altogether, 9,091 lin. ft. of pipe were installed in 157 different locations. Of this, by far the larger part of the pipe was in diameters of 24 in., 36 in., 48 in., and 60 in. Only one or two installations were made with pipe less than 24 in. in diameter, and only 60 ft. of 30-in. pipe was used. All of the pipe of 36 in. diameter or less was made from 10-gage material, regardless of the height of fill it was to support, and all of the pipe of 48-in. diameter, or larger, was made from 8-gage material. Pipe for each installation was ordered separately and was delivered in sections ranging in length from 12 to 20 ft., by 2-ft. increments. The weight of the pipe varied with its size and gage, a 20-ft. section of 24-in., 10-gage pipe weighing 906 lb.; a similar length of 36-in., 10-gage pipe weighing 1,338 lb.; a 20-ft. length of 48-in., 8-gage pipe weighing 2,170 lb.; and the same length of 60-in., 8-gage pipe weighing 2,734 lb.

Established Three Unloading Depots

In order to expedite the handling of the pipe to position along the line, three points of unloading and distribution were used: Egbert and Pine Bluffs, Wyo., on the main line at the south end of the new work, and Creighton, the northern terminus of the new line. By selecting these points, the maximum haul to any part of the line was limited to 28 miles.

For the most part, transportation of the pipe was





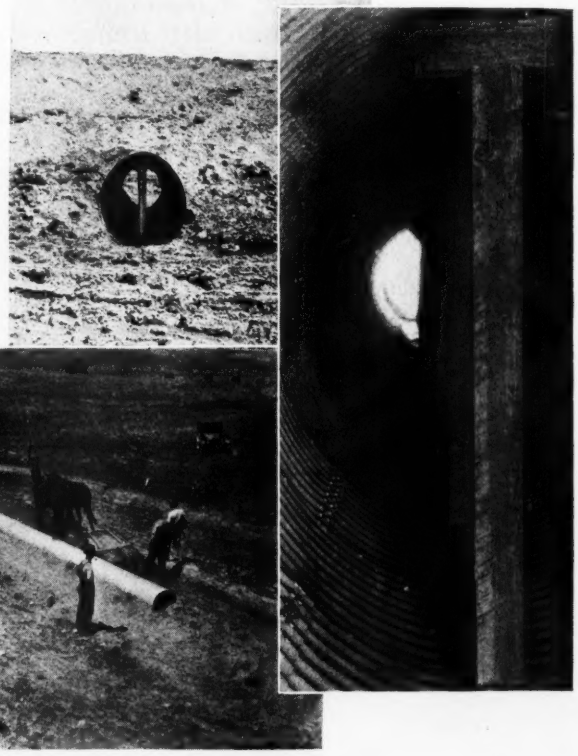
Above—Banding a joint in a 36-in. culvert which was carried through a rock ledge

Right—Ten sections of 24-in. pipe ready to be moved out on the line

done by motor trucks carrying from three to ten sections at a time, depending upon the diameter of the pipe. At many points where the sites of installation were inaccessible to trucks, part of the haul was made on wagons or stone boats, or the pipe was simply pulled along the ground by teams of horses. In the five-mile stretch of unusually rolling country, even these simpler methods of transportation were ineffective in a number of cases, because of deep ravines and gullies near the points of installation. In these cases it was frequently found most effective to haul the pipe sections as near as possible to the points of installation, and then to let them roll down the hillsides under the control of ropes looped around them. This method was used only when within a few hundred feet of the site of installation, and where the contour of the ground made it practicable. It proved very effective, however, and in some instances, as many as 12 lengths were lowered at one time by this method.

Care Taken in Setting Pipe

One of the most interesting features in connection with the culverts was the method of their installation and the precautions taken to insure that they would retain true alinement and shape under fills ranging from less than a foot to a maximum depth of over 95 ft. Careful consideration had to be given to the fact that filling over most of the culverts was to be done from one side, with trucks dumping over the end of the embankments.



Left—Back-filling and covering a 24-in. pipe with a drag scraper

Top—A 60-in. culvert pipe with a finished cover of only 7½ ft., before strutting was removed

Right—Details of the strutting system installed in a 60-in. pipe

The different culvert installations varied in length with the widths of the fills, the longest being 345 ft. These different lengths were built up of 20-ft. sections of pipe, plus short sections at one end, if necessary, to produce the over-all length desired.

Joining of the separate lengths was done directly on the site of installation by means of circular split bands of the same material as the pipe itself and with similar corrugations. These bands were of 12-gage material and were 12 in. wide for 24-in. and 36-in. pipe; 18 in. wide for 48-in. pipe; and 24 in. wide for 60-in. pipe.

In assembling two sections of pipe, one of the bands was spread open and slipped over the end of one section for half of its length, and then, with the end of the other section of pipe slipped into the free half of the band, so that the ends of the adjoining sections abutted each other, the band was drawn up tight over the pipe by means of a series of bolts in a clamping arrangement over the slit in the band.

Foundations for the culverts were prepared carefully to give a smooth even bearing for the pipe on a slope sufficient to insure complete runoff. Wherever possible, the pipe was laid in a trench, cut as narrow as possible and with a curved bottom to fit the contour of the pipe. When in place, the spaces along the sides of the pipe were carefully back-filled with material which was thoroughly tamped to build up maximum resistance to the side thrust of the walls of the pipe, caused by its tendency to increase in horizontal diameter under load. Where it was necessary to install the pipe on the surface of the ground, particular attention was given to compacting the material along both sides and then over the top. Whether installed in a trench or on the surface of the ground, the most thorough tamping was done on the side opposite that to receive the load of the fill first.

Pipe Strutted Until Embankments Settled

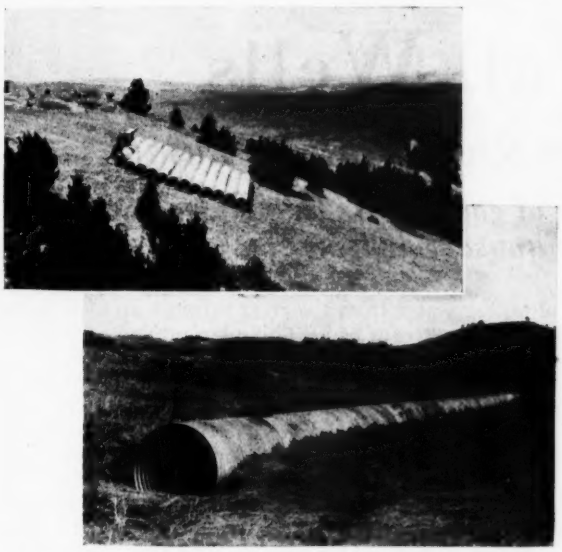
Another measure taken to prevent distortion of the larger diameter pipes, while being subjected to unequal loading and during settlement of the fills, was to create initial elongation of the vertical diameters by means of inside struts. This operation decreased the horizontal diameters of the pipes and, therefore, after the material along the sides of the pipes had become compacted by the weight of the fills above, increased resistance was afforded to the side thrust of the walls of the pipes when the struts were removed. Only pipe of 48-in. diameter or more was strutted, this being done in the larger pipes regardless of the height of fill under which they were to be installed. The amount of initial elongation of the vertical diameters of the pipes was varied with the height of the fills, however, and ranged from

about 2 in. to 4½ in., or from about 4 to 8 per cent of the normal diameters of the pipes.

All of the strutting was done by using a 4-in. by 4-in. longitudinal sill in the bottom of the pipe, either one or two 4-in. by 4-in. longitudinal stringers under the crown of the pipe, and 4-in. by 4-in. vertical struts with soft wood compression caps, spaced from 3 ft. to 4 ft. apart throughout the length of the pipe. The compression caps, which were of 4-in. by 4-in. material and about 1 ft. long, were placed transversely to the stringers and were used to allow the vertical diameter of the pipe to decrease gradually as the fill was being made.

The sills and stringers ranged from 8 ft. to 16 ft. in length and were so arranged in the top and bottom of the pipe that the joints between lengths were staggered. The strut spacing varied somewhat with the conditions encountered, but the struts were usually spaced closer together under the higher part of the fill.

The struts were installed with two 35-ton screw jacks, working progressively from one end of the pipe. The first strut was placed with a jack on each side of it, one just outside of the pipe and the other midway between the strut being placed and the position of the second strut. The second strut was then installed by moving the outside jack to a position in the pipe about midway between the positions to be occupied by the second and third struts. In this manner, progressing through the pipe, all of the struts were installed. In several instances, where a high fill was to be brought on the pipe from one side, the struts were inclined slightly toward the oncoming fill to resist the uneven loading.



Above—Lowering 11 Sections of 24-in. Pipe Down a Steep Slope. Below—A 130-ft. Culvert of 36-in. Pipe Laid With 50 Per Cent Projection

Pipe Stands Up Well Under High Fills

The following details concerning three typical installations under high fills show the methods used and the condition of the pipe after a number of months of service. At Sta. 1684, a 48-in. pipe of 8-gage material, 176 ft. in length, was installed under a 48.8-ft. fill. This culvert was installed with 75 per cent projection or, in other words, with only the bottom one-fourth in a trench, and was laid on a foundation of ordinary soil. The first 10 ft. of fill over the pipe consisted mainly of sandy soil and was placed by a drag scraper, while the remainder of the fill was made with sandstone dumped into place from dump cars.

This culvert was strutted by the method described previously to give the vertical diameter an initial elongation of 6.52 per cent. The struts were removed about six months after the completion of the fill, at which time the strutting system showed a compression of 2.65 per cent. During the removal of the struts, the vertical diameter of the pipe shortened about 0.08 per cent, and during the next nine months, the pipe deflected an additional 0.77 per cent of its original diameter. At that time there still remained a residual elongation of 3.04 per cent and the culvert was in excellent condition.

At Sta. 1793, a 260-ft. culvert of 60-in. 8-gage pipe was installed under a fill 77.39 ft. in height. This installation was made with about 50 per cent projection on a foundation of gravel and rock, and was given a vertical diameter elongation of 4.70 per cent by strutting.

During the first five months following the completion of the fill, the struts compressed 1.93 per cent and during the next nine months, with the struts removed, the pipe deflected an additional 0.57 per cent, leaving a residual elongation of 2.22 per cent.

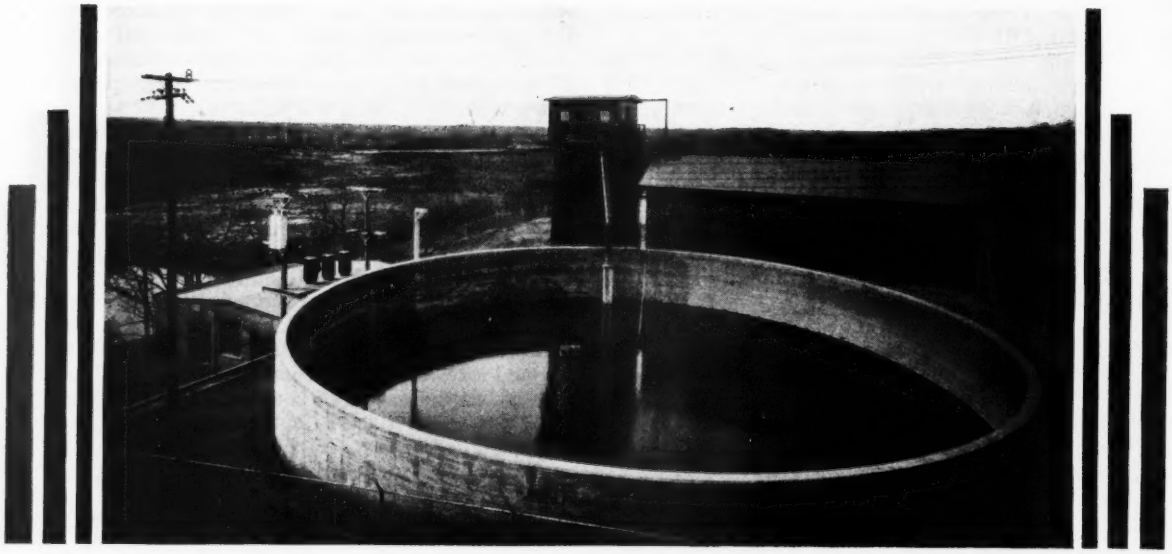
Under a Fill of Almost 92 Ft.

At Sta. 1822, a 320-ft. culvert of 60-in. 8-gage pipe was placed under a 91.94-ft. fill, with about 75 per cent projection above the natural ground. Filling in this case was done with motor trucks in lifts of about 20 ft. each. The pipe was strutted and was given an initial elongation of 5.25 per cent, and the compression of the strutting during the filling and for about six months thereafter, when the struts were removed, was 2.60 per cent. The drop caused by the removal of the struts was 0.07 per cent, and the deflection during the following ten months was 0.22 per cent, leaving a residual elongation of 2.36 per cent at that time. This installation showed less deflection than any similar installation on the line, which was due, it is believed, to the manner in which the fill was made.

In addition to the installations under high embankments, a large number of installations were made under fills ranging from two to six feet in height. In these cases, specifications called for a minimum cover to the bottom of tie equal to the diameter of the pipe, but in several instances this could not be complied with. In one installation of 24-in. pipe the possible cover was less than a foot.

In strutting the larger diameter pipes under the shallower fills, only small initial elongation was provided, as it has been found that under such fills, there is little tendency for the pipe to flatten. In some instances, the vertical diameter of the pipe has actually increased slightly under traffic, this being due to the unusually effective compacting of the material along the sides of the pipe. In view of the character of the territory traversed by the new line, it is felt that construction work was speeded up materially and that sizeable economies were effected by the use of the corrugated metal pipe.

The North Platte cut-off was built under the general direction of H. C. Mann, chief engineer of the Union Pacific, and G. J. Adamson, chief engineer of the Union Pacific Railroad, and was carried out under the direct supervision of W. S. Woodworth, assistant engineer.



The Water Treating Plant at Shawnee

Rock Island Turns to

Gravel-Wall Wells

After Salt Pollution Makes River Water Unusable

Efforts to provide adequate supply of good water at Shawnee have been beset with many unusual difficulties

SIX gravel-wall wells were the means of solving a critical water-supply problem at Shawnee, Okla., on the Chicago, Rock Island & Pacific, and the construction of these wells comprises the latest chapter in an interesting story of repeated efforts to provide satisfactory water in adequate quantities at that place in the face of a series of unusual obstacles. A favorable location for these wells was discovered only after extended prospecting that entailed the drilling of no less than 72 test holes to an average depth of 40 ft. The motors operating the individual well pumps are remotely controlled, with special apparatus providing a check on their operation at the point of control.

Two Sources of Water Available

Two sources of water supply are afforded in the vicinity of Shawnee, the Canadian river and gravel pockets overlying a stratum of red shale known throughout the Southwest as "redbed" that is encountered at depths ranging from 20 to 40 ft. below the ground surface. Owing to the fact that the gravel pockets are not continuous, prospecting for water is a matter of considerable uncertainty.

The first comprehensive effort of the railway to provide an adequate water supply at Shawnee was made in 1902 when two open brick-curbed wells were excavated to a depth of 25 to 30 ft. As the supply thus obtained proved inadequate, a small pumping plant was erected on the river bank for the purpose of taking water from the river through an intake pipe laid in the stream bed. This plan proved only partly successful and it became necessary for the railway to supplement its own supply by water purchased from the city.

In 1915 further efforts to use river water were carried out by constructing two open wells in the river bed to serve as intakes for a suction line from the pumps and, while these intakes tended to increase the supply, they were in use only a short time when a period of high water resulted in filling them full of mud and putting them out of service. As a consequence, it was necessary to continue the purchase of considerable quantities of water from the city, but by 1927 a shortage of city water made it imperative for the railroad to take further steps to increase its own supply.

This time the railway again turned to the river for its water and provided an intake that insured an uninterrupted supply, but a drastic change had taken place in the character of the river water which pointed to the need for a treating plant of special design. The water of the Canadian river had always been one of moderate hardness, containing an average of about 19 grains of incrusting solids per gallon, but varying from 14 to 27 grains with the season and the rate of discharge. However, the rapid increase in population and industrial development of Oklahoma City, situated 39 miles up the river from Shawnee, had resulted in an extreme pollution of the river water. To

make matters worse, Oklahoma City, to insure an adequate supply of water for its own needs, had constructed a dam across the river to provide an impounding reservoir. As a consequence, very little of the river flow is permitted to pass this dam during periods of low water so that the river below the city carries little more than the effluent of the Oklahoma City sewers at such times.

A Special Problem of Treatment

In view of this, the problem of treating the water from the river for locomotive use at Shawnee entailed not only the removal of incrusting solids, but also the elimination of the objectionable effects incident to the heavy pollution. This requirement was met by the construction of a plant that is a combination of a continuous water softener and two large settling basins that are operated on the alternate or intermittent basis.

The treating plant proper consists of a tank 18 ft. in diameter by 28 ft. high, served by an adjacent chemical mixing and storage house. The distinctive feature of the plant is the fact that this tank serves solely as a reaction chamber, raw water being admitted at the bottom, where the chemicals are discharged through a pipe extending from the proportioning equipment enclosed in the house at the top. The flow is, therefore, upward to outlets discharging alternately into either one or the other of the two settling basins. The plant has a capacity of 50,000 gal. per hr. and the reagents used are lime, soda ash and sodium aluminate.

Settling Basins an Important Feature

The two settling basins are of concrete, 75 ft. in diameter by 16 ft. deep, with conical bottoms provided with sludge outlets. The treated water is allowed to stay in the basins from 10 to 12 hours, after which it is drawn off through float outlets that can descend into the tank only to a predetermined minimum distance from the bottom so as to allow an ample depth for the accumulation of sludge, which was flushed out at suitable intervals. The period of settlement was also effective in releasing much of the entrained gases that were present in the water by reason of its pollution.

Laying the Pipe in the River Bed

Raw water was delivered to the treating plant from the river by two centrifugal pumps driven by 25-hp. electric motors, while provision for the delivery of the treated water from the settling basins to the railway yard at Shawnee is afforded by two centrifugal pumps driven by 50-hp. motors, the water being pumped through 3,800 ft. of 12-in. pipe.

This plant was completed in December, 1927, and proved thoroughly effective in supplying water entirely fit for boiler use and resulted in definite economies in operation and boiler maintenance. However, during the summer of 1929, the river water became subject to an entirely new form of pollution that proved to be a source of serious trouble to the railroad. Late in 1928 a marked development occurred in a newly discovered oil field in the vicinity of Oklahoma City, which resulted, during the following year, in the dumping of large quantities of salt water into the river, and with the decrease in the flow of the river in the late months of 1929, the effect of this salt became manifest not only in an increase in the hardness of the water, but by the presence of

Another view of the Shawnee plant — The treating tank flanked by the two settling basins is seen in the background, a part of the pump house appears in the foreground

chlorides in amounts running as high as 288 grains per gallon and averaging about 46 grains for the five months from November, 1929, to March, 1930, inclusive. The change in the character of the water during this period is indicated in the tables of approximate

Data on the Dissolved Solids in Canadian River Water at Shawnee Before Pollution from the Oil Fields

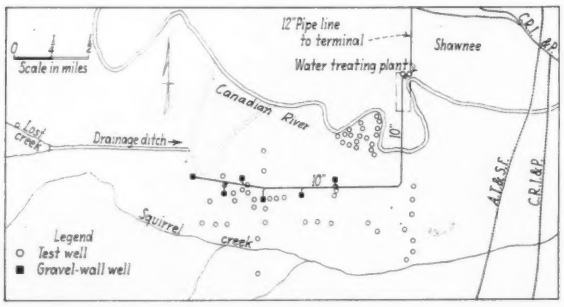
	Grains per Gallon
Average Hardness	19.5
Average Alkalinity	14.5
Average Chlorides	11.9

Data on the Dissolved Solids in Canadian River Water at Shawnee After Pollution from the Oil Fields

	Grains per Gallon
Average Hardness	26.9
Average Alkalinity	15.0
Average Chlorides	45.8

The effect of this heavy concentration of chlorides was an epidemic of leaking flues and an extraordinary corrosion of boilers, a condition calling for prompt remedial measures. Since correction of the river water was seemingly hopeless, attention was directed to a search for another supply. The search was directed in particular to a stretch of ground about 1½ miles long and a mile wide on the south side of the Canadian river, approaching Shawnee. This area slopes upward to the south and lies between the river and Squirrel creek, which flows parallel to the river on higher ground. The subsurface water in this area, therefore, consists to a considerable extent of seepage from the creek and is also affected by the discharge from a drainage ditch approaching this area from the west. It is only during periods of high water in the Canadian river, when concentration of dissolved solids is always lowest, that the subsurface water supply in this area is influenced in any measure by the river water. Therefore, water available from this new source is almost entirely free of the pollution which made the river water so highly objectionable and, while subject to considerable variation in mineral content, is substantially a carbonate water containing about 31 grains per gallon of dissolved solids, of which about 24 grains are incrusting solids.

Following an intensive exploration of this area, during the course of which 72 test wells were driven



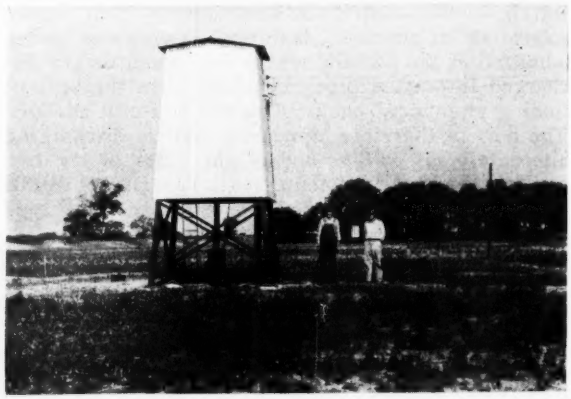
Map of the Area Explored for Water

to an average depth of 40 ft., six locations were selected as offering favorable possibilities for the driving of wells. At each of these locations a 42-in. well was put down by the rotary process, the cutter being followed by a light steel shell. A 16-in. casing was then inserted in the well, with a 12-ft. Fairbanks-Morse porcelained cast-iron strainer at the lower end. The 12-in. annular space between the casing and the shell was then filled with a washed well-graded gravel, after which the 42-in. shell was withdrawn.

Each well was equipped with a Price 7-in. 9-stage turbine pump placed about 8 to 10 ft. from the bottom of the well, but with the end of the suction pipe extending to within three feet of the bottom. These pumps are driven by 15-hp. motors installed in small houses covered with galvanized iron and set up on structural steel legs to place the floors well above high-water level in the river. The tops of the wells are enclosed to keep out the river water.

Provide Remote Control

These pumps discharge into six-inch branch discharge lines that are connected into a main discharge line that ranges from 8 in. to 10 in. in diameter. Check valves in the individual discharge lines prevent back flow into the wells when any or all of the pumps are not working. The problem of carrying



As the Ground at the Site of the Wells Is Subject to Overflow the Pumphouses Were Placed on Stilts

the discharge line across the Canadian river was met by the use of Universal pipe which was laid in the stream bed during low water.

The pumps are started and stopped by individual push-button controls at the treating plants and, to afford knowledge of the performance of the individual pumps, each discharge line has been tapped to permit the installation of a Mercoid switch which is electrically connected to a small lamp on the control board in the treating plant. When the pump is in operation, the pressure in the discharge line actuates the switch and lights the lamp, while in the event of a lack of pressure due to a failure of the pump to start the light will not burn.

Ample Supply Assured

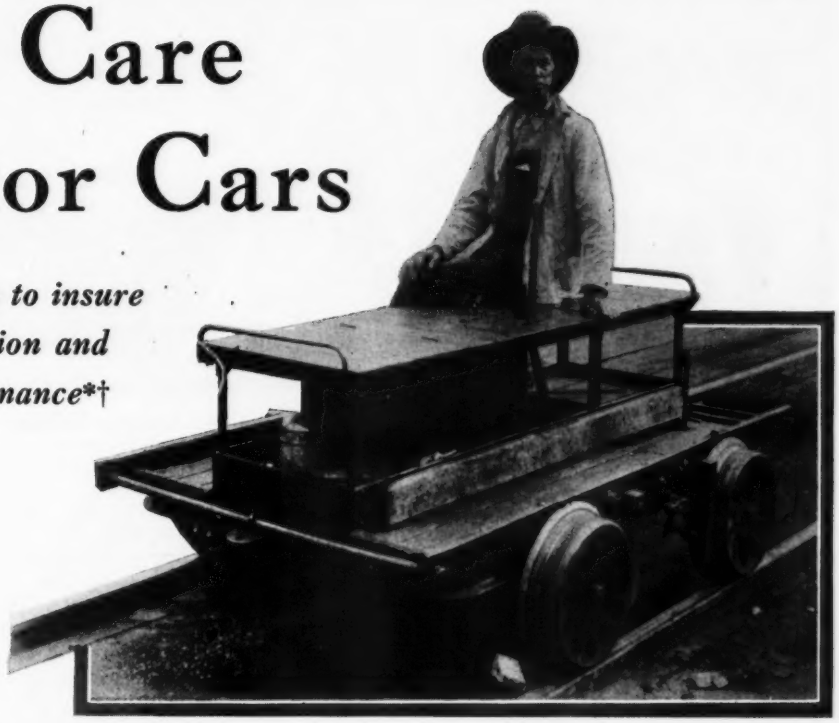
The total capacity of the wells is 1,050 gal. per min. or a total of 1½ million gal. per day, which is about equal to the maximum abnormal demand for water at the terminal.

The improvements made in 1927, as well as the development of the water supply during the present year, were planned by Paul M. LaBach, engineer of water service of the Chicago, Rock Island & Pacific, in collaboration with the Railroad Water & Coal Handling Company of Chicago, the contractors for the construction of the facilities. The work was carried out under the general supervision of A. T. Hawk, engineer of buildings.

The Care of Motor Cars

Essential precautions to insure satisfactory operation and economical maintenance*†

By C. R. KNOWLES‡



A car used in section service daily for more than nine years without going into the shop for repair

THE necessity for proper care at all times should be so apparent to everyone who operates a motor care that it should hardly be necessary to call attention to it; yet the many failures of motor cars to render good service that may be traced directly to neglect indicate that there is much room for improvement in the care of cars. Neglect to take the proper care of motor cars is not at all uncommon; it is usually due to carelessness or ignorance.

It should be made clear to everyone in charge of a motor car that it must be given the proper care at all times, whether in actual service or not. Definite instructions should be issued as to cleanliness, inspection, loading, care of car when not in use, and other similar items relating to the care of the car. These instructions should be followed up by supervisory officers to see that they are carried out.

The most important way to insure proper care of a car is to have one man operate it and hold him responsible for its condition at all times. If different men are allowed to operate the car there will be divided responsibility, coupled with different ideas as to how it should be handled. As a result it is almost sure to be neglected.

Protection When Not in Use

Proper provisions for the care of a motor car when not in use are of equal importance with the care required in actual operation, as the deterioration may be even greater when it is not used for any length of time than that resulting from constant service.

Motor cars must necessarily be exposed to the elements when in use but there is no good reason why they should not be protected from the weather and from dust, dirt and cinders when not in use. This will add both to their appearance and to their efficiency of operation. A canvas cover is usually provided for the protection of the car when it cannot be placed in the tool or motor car house. The cover should be fastened in place so that it will not be blown off by the wind.

If motor cars are to be laid up for an indefinite period, the parts subject to damage from corrosion or rust should be protected with oil or other coating and if not housed under lock and key parts subject to theft, such as carburetor, oil cups and similar items, should be removed from the car and placed in safe keeping. Gasoline should be drained from the tank and carburetor as a precaution against fire. Cylinder jackets, radiators and water hoppers should be drained in cold weather to prevent damage from freezing.

Setting On and Off Track

Foremen and motor car operators seldom realize the amount of damage done to a motor car through carelessness in placing it on and off the track at road crossings, set offs and elsewhere. Dropping the car a few inches when setting it down or bouncing it over the rails will do more damage than the ordinary wear for a month. Rough handling of a car on and off the track damages wheels and axles, distorts the frame, strains rivets, loosens bolts and nuts, and may damage bearings, cylinders, pedestals, flanges and plates. Many motor-car failures laid to the breakage of some part from an "unknown cause" may be traced directly to rough handling at a road crossing.

The men who assist in handling the car on and off the track should be so organized that each man has a certain duty, and they should be instructed as to the manner in which the car will be handled. The same procedure should be followed each time that

* This is the seventh of a series of 12 or more articles on the Care and Operation of Motor Cars, the first of which, on the Place of the Motor Car in Railway Work, appeared in the January issue, page 5, the second, on the Type of Motor Car, in the February issue page 54, the third, on the Motor Car Engine, in the April issue, page 158, the fourth, on How a Motor Car Is Built, in the May issue, page 214, the fifth, on Proper Lubrication, in the June issue, page 248, and the sixth, on Ignition, in the July issue, page 295.

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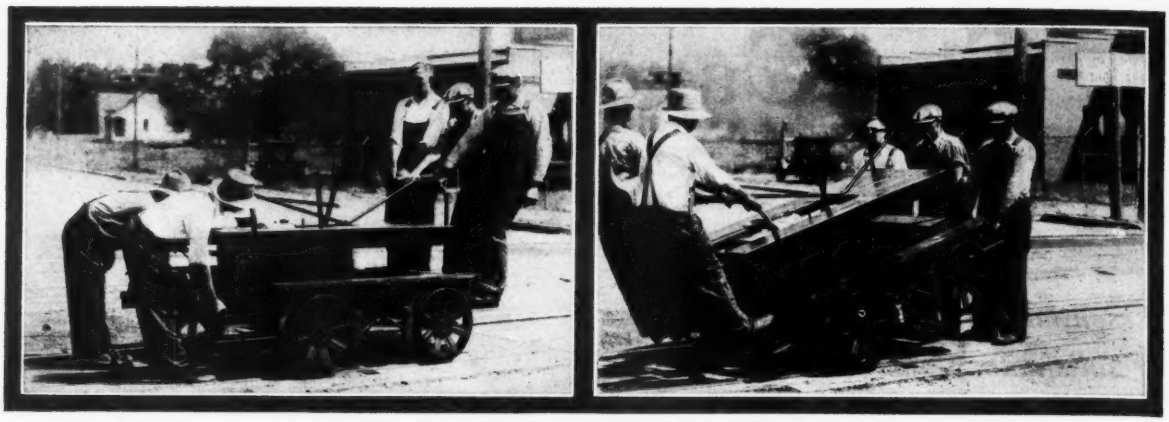
‡ Mr. Knowles is in charge of the operation and maintenance of motor cars and other gasoline-operated work equipment on the Illinois Central System.



Two Steps in the Removal of a Car at a Crossing

Two men lift loose axle end of car out of flangeway while remaining men counterbalance weight of car at other end

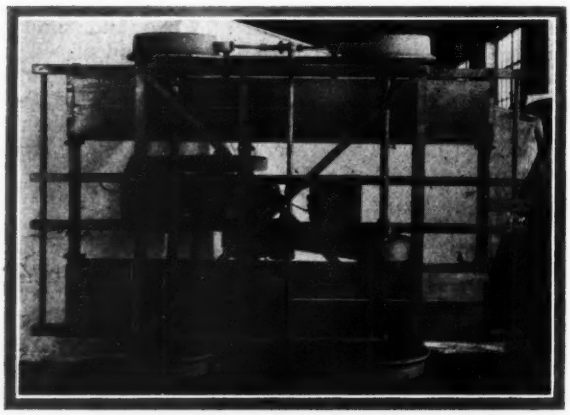
Three men lift and swing drive axle end of car across track preparatory to pushing car in the clear while two men counterbalance other end

it is necessary to place the car on or off the track. Particular care should be taken to avoid cramping the wheels in the flangeways of a crossing as this is the cause of many bent and broken axles. When a car is to be set off at a road crossing or on the right of way, select a level spot for the car to rest on so that all four wheels are supported, thereby avoiding springing the frame and axles out of line.

Inspection

Careful inspection of the motor car at frequent intervals avoids breakdowns, prevents accidents and adds to the life of the car. It should be inspected each time before starting on a trip to see that the wheels are in gage and line, that the brakes are in good order, that all bolts and nuts are tight and that the necessary tools and signaling equipment, such as flags, lights, fusees, torpedoes, etc., are in place. All bearings should be examined to see that they are properly lubricated, and the fuel tank checked to be sure of an ample supply of gasoline.

The car should be turned on its side at least once



A Motor Car Should Be Turned on Its Side for Thorough Inspection Once a Week

a week and a thorough inspection made of all parts. The safety of the car depends very largely upon the condition of the wheels and axles; frequent inspections should therefore be made to see that they are in safe operating condition. Wheels should be examined carefully to insure that the hub bolts or rivets are tight. Where wood center wheels or wheels with detachable rims are used, the rim bolts should also be examined. The wheel tread and flange should be watched carefully to see that there is no undue wear of rim or flange, for sharp flanges are responsible for many derailments. All wheels except the loose wheel should be tight on the axles and the nuts secured by cotter keys. The loose wheel should not have any lateral motion and should fit snugly on the axle, for where too much play is permitted in either the axle fit or the lateral movement, the wheel will run out of line and may cause a derailment. The wheels should also be trammed to see that they run true and in line.

Axles should be examined to see that they run true and are not sprung or bent. Thrust collars should fit up snug against the bearing boxes. Axle bearings should not be worn or cut so that the diameter of the axle is reduced, as badly-worn axles increase the possibility of their breaking.

Thorough inspection of the brakes is important, as they should be in good condition at all times. The shoes should have full bearing on the wheels. Where a brake band and drum are used, the band should be adjusted so that it will just clear the drum on the lower side and in such a manner that the band will not drag on the top of the drum. The brake band lining should not be allowed to become worn to such an extent that the brake band comes in contact with the drums as it will not only reduce the effectiveness of the brake but may wear the band to the breaking point.

There should be no lost motion in the levers, toggle joints and pins of brake rigging that might prevent the proper application of brakes. All bolts and pins should be in their proper place and secured by cotter keys. Proper inspection and adjustment of brakes is imperative if they are to render effective service when needed.

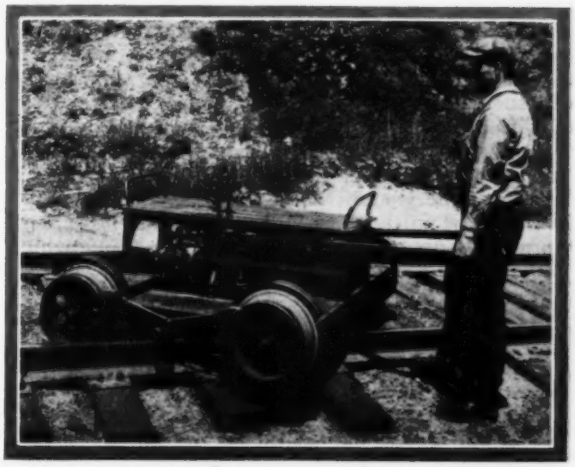
Cleanliness

A clean motor car rarely gives any trouble and will stay out of the repair shop longer than a dirty car. One reason for this is that when a car is clean every part is open to inspection and defects are often made apparent before they result in serious damage. There is also less wear on the moving parts as dirt and grease allow sand and cinders to collect and work into the bearings and other parts of the mechanism. Therefore the keeping of a car clean, in addition to improving its appearance and denoting pride on the

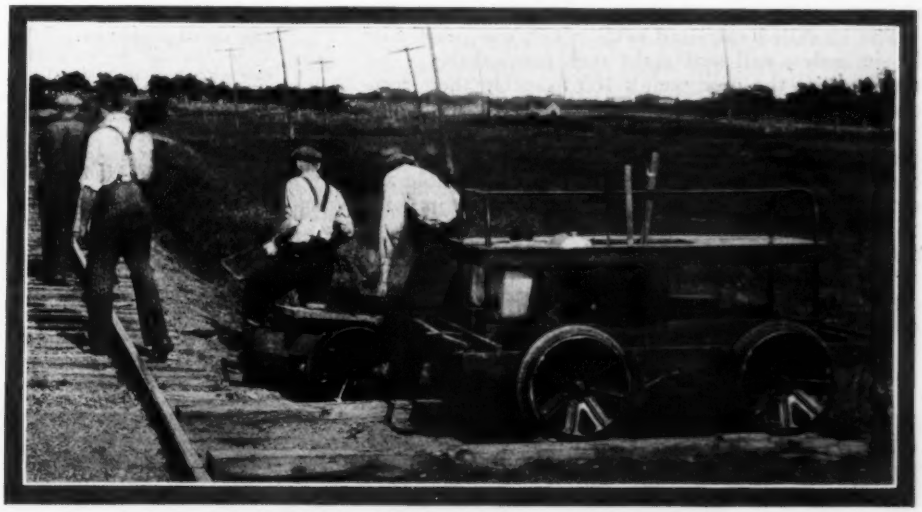
part of the operator, also improves its operation, reduces the cost of maintenance and lengthens its life. That cleanliness has a direct bearing on the cost of maintaining and operating motor cars is shown repeatedly by the condition of cars passing through repair shops. It is invariably found that dirty cars require more repairs and are less reliable in operation than those which are kept clean. This is, of course, to be expected, as, aside from the direct effect of the dirt itself, it is apparent that if the operator takes sufficient interest in the car to keep it clean, he will also keep it in good condition otherwise.

While every part of the car should be kept clean, this is of particular importance with the engine. Allowing the engine to become incrusted with oil, dust and cinders permits dirt and grit to work into the bearings, thus causing excessive wear and damage to the moving parts. Improper firing is frequently due to an accumulation of dirt on and around the spark plugs and timer. Grease and dirt also destroy the insulation on the wiring and cause short circuits. The woodwork should be kept free from dirt and grease as it will become very inflammable when oil-soaked. A dirty car and engine add to the danger of the car being destroyed by fire in the event of a leaking gasoline connection.

Cleanliness is essential to proper inspection, as an accumulation of dirt will often prevent the discovery of defects that would be apparent on a clean car. No set time should be fixed for cleaning the car. It should be clean at all times. Wipe off the engine, its accessories and the other parts of the car daily or oftener if necessary. Clean all places difficult of access as well as the exterior parts. Sweep the deck of the car to remove dirt and cinders. Remove mud by scrubbing if necessary. Keep oil and grease cans and funnels clean, both inside and out. Do not permit greasy waste, old clothing, broken tools or spare parts to accumulate on the car, as they increase the fire risk, add weight, and certainly do not improve the appearance of the car.



Special Care Should Be Exercised in Removing a Car From the Track Where No Setoff Is Provided



A car should be placed on a setoff when not in use, to avoid distortion of frame

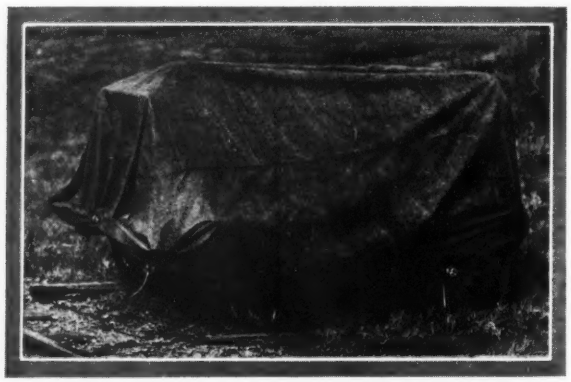
Keeping Bolts and Nuts Tight

The importance of keeping bolts and nuts tight and the different parts of the car in proper alinement is often overlooked or disregarded. Loose bolts mean poor alinement, followed by rapid wear, if not the actual failure of some important part. Regardless of whether the frame construction is of steel or wood, the bolts should be watched carefully and tried frequently in order to make sure that they are tight. This applies to all bolts attaching the various units, engine axle boxes, frame and other parts. Do not use a Stillson wrench or pliers on square or hexagon head bolts or nuts as the corners will become worn and useless. Use an open end wrench, a socket wrench or a monkey wrench for this purpose. Always use washers under nuts on wooden parts of the car to avoid undue wear. Keep all parts in proper adjustment but avoid undue tinkering with the car. The modern motor car is the result of years of development and its operation can rarely be improved by making other adjustments than those designed by the manufacturer.

Loading

A study of motor-car loading indicates that as a rule no load limit is recognized by track gangs or others. The loading is usually limited to the number of men in the gang and such tools as can be piled on the car, or in rare cases to what the foreman may consider a safe load. No uniform standard of load ratings has been established by either the railroads or

the manufacturers. In justice to the latter it is only fair to state that their reluctance to establish a definite load limit for different sizes of axles is due to the fact that the conditions surrounding the operation of the car, such as speed, the character of the track and the condition of the car and axles are beyond their control. Any rating that they might establish would have to be based upon the supposition that the axles, bearings, wheels and frames were in good shape, and it would be misleading when applied to cars with worn axles, poor bearings or wheels or a frame which



An Idle Car Should Be Protected by a Tarpaulin

might have suffered from excessive wear or neglect.

An arbitrary normal loading for various types of cars, based upon the size of the axles, was set up in a previous chapter of this series as follows: (See Chapter 4, Design and Construction of Motor Cars.)

Light inspection cars	$1\frac{3}{16}$-in. axle 650 lb.
Section cars	$1\frac{7}{16}$-in. axle 1500 lb.
Heavy duty cars	$1\frac{11}{16}$-in. axle 2000 lb.
Heavy duty cars	$1\frac{15}{16}$-in. axle 2500 lb.

The so-called standard section car, equipped with $1\frac{7}{16}$-in. axles, will seat eight men comfortably. Assuming that the men weigh 160 lb. each, their combined weight is 1280 lb. Tools ordinarily used by a gang of this size will weigh approximately 500 lb., giving a total weight of 1780 lb. This is in excess of the permissible loading given in the above table and would necessitate the use of a trailer to carry the tools. If the car is known to be in thoroughly good condition and is properly operated, the arbitrary load rating given above may be increased to permit of carrying this load on $1\frac{7}{16}$-in. axles. Applying the same rule to the other types of cars, a revised table of load rating is as follows:

Light inspection cars	$1\frac{7}{16}$-in. axle 800 lb.
Section cars	$1\frac{7}{16}$-in. axle 1800 lb.
Heavy duty cars	$1\frac{11}{16}$-in. axle 2500 lb.
Heavy duty cars	$1\frac{15}{16}$-in. axle 3000 lb.

It is recognized that the axles will carry much greater loads than those given in the above table before the point of ultimate failure is reached, but in order to provide a proper factor of safety for axles of different kinds it is felt that the loadings as given should not be exceeded. As stated previously, the speed of the car and its condition, particularly the wheels and axles, should always be considered in determining the safe carrying capacity. For example, a load that would be safe at 15 miles per hour with wheels and axles in good condition may be unsafe at 25 miles per hour, or with worn wheels and axles.

The overloading of motor cars may not result in an accident but its effect is always reflected in the maintenance cost of the car. Many operators do not realize this. They think that it is all right as long as the car handles the load, and overlook the fact that any car that is operated in an overloaded condition will become racked and more or less loosened at every joint. This increases the cost of maintenance and shortens the life of the car. Heavy material such as rails, frogs, switches, ties and bridge timbers should always be handled on trailers and never loaded on the motor car.

Rules

The following rules have been drafted as representing good practice in care of motor cars:

(23) Protect the car from dirt and the weather when not in use. It will deteriorate more rapidly from neglect when idle than from use.

(24) Care should be exercised in setting the car on and off the track. The frame of a car is often sprung and the axles bent or broken by careless handling.

(25) Inspect the car before starting on a trip to see that it is in proper condition and that it is supplied with fuel and signal equipment.

(26) Turn the car on its side once a week and inspect every part of it in detail. Make such adjustments as are necessary for its safety and efficient operation.

(27) Keep all parts of the car and engine clean and free from grease and dirt. A clean car rarely gives any trouble and costs less to maintain.

(28) Keep all bolts and nuts tight and avoid excessive wear through poor alinement.

(29) Do not use pipe wrenches and pliers to tighten bolts and nuts.

(30) Make all necessary adjustments but avoid tinkering with the car. Before you take the car apart, be sure that it is necessary.

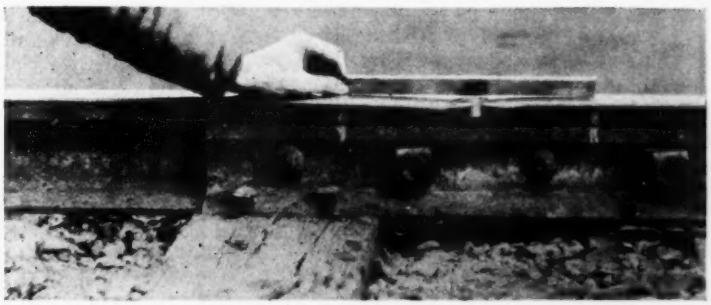
(31) Do not overload a motor car, as it may result in permanent damage to the car if it does not lead to an accident.

Grade Separation on the Baltimore & Ohio Near Relay, Md.

What Are the Causes of Rail Batter?

A study of the records of rails which did not batter at the ends and the reasons for their immunity to this deformation

By C. W. BALDRIDGE
Assistant Engineer,
Atchison, Topeka & Santa Fe,
Chicago



LIKE MANY other questions with which we are confronted from time to time, the cause of rail batter can best be determined by going back to the beginning of the subject or as far back as information is available.

Rail batter, like some other railway track problems, is not of recent origin. In the days when the tracks were constructed with wrought iron rails, rail batter was an ever present trouble. One does not have to depend wholly upon written history of the battered ends of iron rails, nor does he have to be a patriarch to have personal knowledge of them, for at least a modest mileage of iron rails were still in use in unimportant branch line tracks and in sidings up to the time of the World War, at which time the high prices for this class of rail resulted in the elimination of practically all of the iron rails which were still in existence at that time.

The History of Rail Batter

These old iron rails showed a great many battered ends and, because of their exaggerated condition, they also showed quite clearly the primary reason for their development. Iron rails were soft and flowed badly, not only at the ends but along the sides of the face of the rail. When the iron rails were superseded by steel rails, the number of battered end rails was very greatly lessened and it is easy to recognize the fact that this decrease was due to the hardness and toughness of the Bessemer steel from which the latter rails were made. It is true that battered end rails occasionally developed in Bessemer steel, but they were so few that it caused little loss to replace them in track and to cut off the mashed end and reuse the remainder of the rail elsewhere.

With the advent of open-hearth steel rails, battered rail ends became more frequent and troublesome. Again, the cause of the battering of these rail ends is the flow of the metal over the ends of the rail, thus lowering the running surface of the rails at the ends, resulting in increased pounding of the wheels and, in many cases, causing a chip to be flaked out of the face of the rail at the end, when expansion of the steel forces the overhanging ends of the rails together.

That the open-hearth steel rails are softer than the older Bessemer steel rails is easily recognized by the greater amount of flow of the metal along the edges of the face of the rails. Contours taken of the various kinds of rails show this difference clearly.

No Batter After 35 Years

Figure 1 shows typical contours, made in 1922, of some 66-lb. Bessemer steel rails rolled in 1887 and laid in the main track of an important railway. After about 25 years in this track they were removed to make way for heavier rails and were relaid on a newly constructed branch line. By 1922, this branch line had become of such importance that these rails were again outgrown and the inspection which was made to determine the necessity for renewal showed their condition generally to be as shown in these contours. This inspection also showed that in the 73 miles of these 35-year-old rails, not a single battered-end rail had developed, although, with the temperature of the rails ranging from 80 to 116 deg., the amount of space left between rail ends to take care of expansion, ranged from zero to 0.85 in. and averaged 0.165 in., or 1/16 in. per joint. Not only were no battered ends found in this 73 miles of track, but the amount which the rail ends were worn down in excess of wear at any point away from the ends averaged only 0.049 in. In the change from main track to branch line, these rails had not been sawed or repaired in any manner, and the same six-hole angle bar joints with which they were originally equipped were used in relaying them.

The output of seven different mills was represented in this steel and the chemistry ranged about as follows:

	Per Cent
Carbon	0.47 to 0.57
Manganese	1.20 to 1.50
Phosphorus	0.09 to 0.14
Sulphur	0.06 to 0.10

With the development of the open-hearth method of making steel and the making of rails from the

open-hearth steel, the trouble from battered end rails again made its appearance, not to so great an extent as prevailed when iron rails were used, but to a much greater extent than had been the case with Bessemer steel rails.

Typical contours of open-hearth rails are shown in Fig. 2. It is unusual to find plain open-hearth steel rails which have handled from 10 to 20 million tons, or more, of traffic, which do not show a "bead" or overhang of metal along the gage edge of the face of the rail and frequently a "dog ear" along the outside edge. These conditions are the result of the

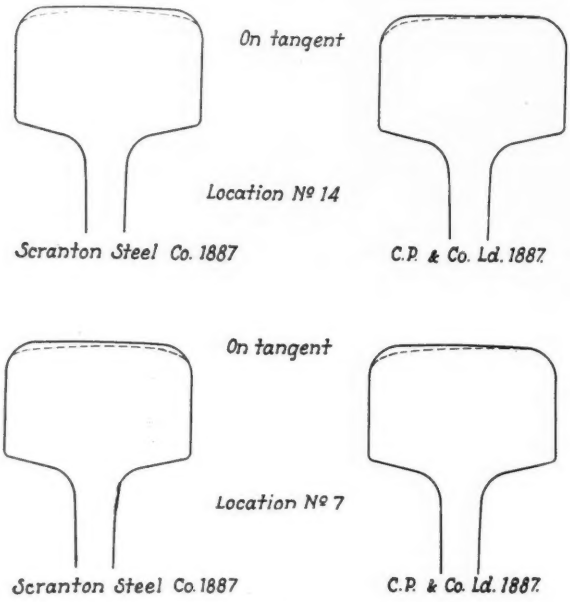


Fig. 1.—Typical Contours of 66-lb. Bessemer Rails After 35 Years' Service

flowing of the metal and show clearly that the open-hearth steel is softer than the Bessemer steel previously used for the manufacture of rails.

From the study of these conditions, it becomes evident that the cause of battered end rails is steel that is too soft or too ductile. The means which can be employed to prevent battered end rails are, therefore, self-evident—go back to the use of a harder and tougher steel.

Rail Used in Track, Not Laboratories

The writer is well aware of the generally prevalent hostility to the use of phosphorus and, until within the past five or six years, of manganese in rail steel, but every track man of long experience knows and does not hesitate to say that the old Bessemer rails wore better than do the open-hearth rails of the present. The investigators working in the laboratories argue to the contrary, but one fact must not be lost sight of, and that is, that rails are made for use in the track, not in the laboratories. Laboratory methods are intended to determine quickly what results will be developed during the life of the rail in track, and if the quick results obtained in the laboratory are not confirmed by the slower results obtained in actual service, it is the laboratory which is wrong.

The elimination of phosphorus from steel is based upon the argument that it makes the steel hard and brittle and results in excessive breakages. If such is the result, the writer has never found proof of it.

From the beginning of the American Railway Engineering Association, the study of rail performance has been very active and discussions of needed improvements have been frequent. Few if any of those discussions, however, have indicated any considerable trouble from the breaking of rails due to brittleness. Representative statements made in the discussion prior to the reduction in the phosphorus content in rail steel are given below.

Opinions Have Long Differed

In the fifth convention, held in 1904 (Proceedings, Vol. 5, page 477), W. C. Cushing, then chief engineer maintenance of way of the Pennsylvania Lines, in discussion, commented on "rails being too soft instead of too hard, resulting in very few broken rails with a clean fracture."

Following Mr. Cushing, Charles S. Churchill, then chief engineer of the Norfolk & Western, stated: "I keep a record of the breaking of rails on our road and, for several years, in no case have I found a broken rail due to chemical analysis. Breaking seems to be due to an incipient flaw in the rail which has been there for a long time."

In the A.R.E.A. convention of 1906 (Proceedings, Vol. 7, page 567), A. L. Buck, assistant engineer on the Canadian Pacific, concluded his discussion of proposed rail specifications as follows: "While we have failures in high carbon rails, they are not resulting from chemistry, but from physical conditions, or qualities of the rail. Without exception, so far, the failure has resulted from a pipe, flaw or seam." This statement was made in advocating the change in A.R.E.A. specifications to provide for (90 to 100-

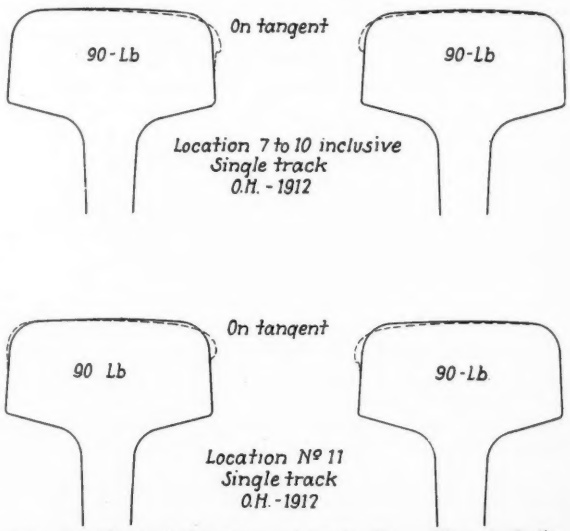


Fig. 2.—Typical Contours of 90-lb. Open Hearth Rails Showing Flow of Metal

lb. rails) a carbon content of 0.55 to 0.65 and a phosphorus content of not to exceed 0.085.

Again in the same volume, page 569, W. F. Tye, then chief engineer of the Canadian Pacific, said: "We have had at least four different orders of 65,000 tons each, rolled to these specifications (same as above). As you know, the Canadian Pacific runs through a rather cold country and yet we have had no such breaks as he speaks of. We have had no square breaks in either the head or the web and we have very few breaks of any kind."

In the same volume, page 571, J. H. Wallace, engi-

neer maintenance of way, Southern Pacific, said: "The specifications of the Southern Pacific Company, under which we have been purchasing rails for several years, calls for what is classed as 'high carbon' steel. Under these specifications, the rails received have averaged about 0.55 carbon, and phosphorus not in excess of 0.085. We do not find that this rail is brittle. I have not the figures at hand, but am satisfied that we have experienced less trouble from broken rails than most roads quoted by the committee in its report. Nearly all of our breakages are due to imperfections in the rail, probably from piped ingots. A flaw of this character, if in the head, causes the head to spread and break down; if in the base or web, it causes breaks of various forms. We are all agreed that excess phosphorus is bad and are desirous of keeping this element as low as possible. I am opposed to increasing the allowable amount of phosphorus and think we should fix the limit regardless of the mill men."

And here the cat is out of the bag—no one has proved that phosphorous up to 0.12 per cent is a detriment to rail steel, but "we are all agreed that excess phosphorus is bad"; that is the way they used to burn witches, no one could prove them guilty but they "all agreed."

How Analysis Affects Strength

Let us look into the record a little. Numerous works on metallurgy carry the information, but to quote the one at hand, Stoughton says, in his second edition of "The Metallurgy of Iron and Steel," page 307, "that every increase in carbon in the steel, gives an increase in tensile strength until we reach a maximum of 0.90 to 1.00 per cent; with further increase of carbon there is a decrease of strength. The amount of increase in the strength of basic open-hearth steel amounts to 770 lb. per sq. in. for each 0.01 per cent of carbon added."

Continuing, on page 309, he states that "Every 0.01 per cent of phosphorus added increases the strength of steel by 1,000 lb. per sq. in." This increase is limited, however, to 0.12 per cent. Above this figure the added hardness causes the steel to become more and more brittle as the phosphorus is increased and naturally decreases its strength.

Also the presence of manganese in basic open-hearth steel having a carbon content of 0.40 per cent increases the strength of the steel by 250 lb. for every 0.01 per cent of manganese added, and, further, this increase in strength due to manganese is increased by 4 lb. per 0.01 per cent manganese for every 0.01 per cent increase of carbon; therefore, with the carbon content at 0.52 per cent, the increase in strength of the steel amounts to 300 lb. for each point of manganese added.

With this information in front of us, let us see what has taken place between the making of the 1887 steel and the making of steel according to the specifications for open-hearth rail steel, as given in the A.R.E.A. Manual of 1929.

	1887 Steel Per cent	A.R.E.A. 1929 Specifications Per Cent
Carbon	0.47 to 0.57	0.67 to 0.83
Manganese	1.20 to 1.50	0.50 to 0.90
Phosphorus	0.09 to 0.14	Not to exceed 0.04
Sulphur	0.06 to 0.10	Not given

The mean of these requirements become:

	1887	1929
Carbon	0.52	0.75
Manganese	1.35	0.70
Phosphorus	0.115	0.02

Assuming the strength of steel at 0.52 per cent carbon as basic, the *added* strength due to the various elements then becomes.

	1887	1929
Carbon	000 lb.	17,700 lb.
Manganese	16,500 lb.	000 lb.
Phosphorus	9,500 lb.	000 lb.
Net increase	26,000 lb.	17,700 lb.

The figures given by the metallurgists showing that the chemistry of the 1887 rail steel provided a stronger steel than does the chemistry of the present day steel, and the statements of the metallurgists that the addition of manganese gives a tougher steel and the addition of phosphorus gives a harder steel, are fully proved by the rails in service.

It thus becomes evident that, because "we all agree that phosphorus in steel is a bad thing," we are now securing steel rails which are not as strong per unit of area, not as tough and not as hard as the rails that were made 30 years and more ago. Also the modern made steel has reintroduced battered rail ends, has newly introduced the "head check" or "detail fracture," failures never before known in rails, and has also introduced the mysterious transvere fissures.

An Early Example of Bridge Design on the M. & St. L.

AMATEUR photography was not as popular two or three generations ago as it is today, with the result that the records of many railway structures of an earlier period have been lost to posterity. Occasionally a photograph of one of these structures comes to light, however, to emphasize the contrast between present day practices and those of the pioneer days of the railways. An example of this is shown in the accompanying illustration of the first

An Early Bridge on the Minneapolis & St. Louis

Minneapolis & St. Louis bridge over the Minnesota river, about 25 miles south of Minneapolis. The bridge was built in 1870 when the railway, despite its name, was only 30 miles long.

The Minnesota river is navigable, by declaration of the War Department of the United States. At the time this picture was taken, in 1877, the main channel was crossed by a wooden-framed bow-string truss swing bridge having a total length of 269 ft. The construction of the trestle approach is equally in-

BRAND ROLLED IN RAISED FIGURES ON WEB OF RAIL						HEAT NUMBERS STAMPED IN DEPRESSED FIGURES ON OPPOSITE SIDE			
ALGOMA Algoma Steel Corp., Ltd. Sault Ste. Marie	**A.R.A.—A 110 LBS.** Section and weight of rail	**SEC 120 —** Algoma section number	**IV 1930** Rolled in 4th month 1930	**O H** Open Hearth	**CANADA** Made in Canada	**1V672** Heat number may be four or five figures. In heat numbers, V is used for 5.	**16** Ingot Number	**B** B Rail	
B.S. Co. Bethlehem Steel Co.	**LACKAWANNA** Lackawanna Plant, Lackawanna, N. Y.	**O.H.** Open Hearth	**IV. 1930** Rolled in 4th month 1930	**110 A.R.E.A.** Weight and section of rail		**C** C Rail	**18** Ingot Number	**28391** Heat number may be four or five figures	
B. S. CO. Bethlehem Steel Co.	**MARYLAND** Maryland Plant, Sparrows Point, Md.	**O.H.** Open Hearth	**IIIII 1930** Rolled in 5th month 1930	**130 LB. A.R.E.A.** Weight and section of rail		**72385** Heat number is always of five figures	**B** B Rail	**18** Ingot Number	
B. S. CO. Bethlehem Steel Co.	**STEELTON.** Steelton Plant, Steelton, Pa.	**O.H.** Open Hearth	**IIIIIII. 1930.** Rolled in 7th month 1930	**136—L. V.** Weight and section of rail		**87341** Heat number is always of five figures	**A** A Rail	**15** Ingot Number	
⊖ **CARNEGIE** Mark Carnegie Steel Co.	**ET U S A** Edgar Thompson Works, Braddock, Pa.	**1930 III** Rolled in 3rd month 1930	**13025** Weight and manufacturers section number	**R E** A.R.E.A. Section	**O H** Open Hearth	**210025** Heat number is always of six figures	**15** Ingot Number	**O H** Open Hearth	**B** B Rail
COLORADO Colorado Fuel & Iron Co. Minnequa Works, Pueblo, Colo.	**SEC. 110. R. E.** Section and weight of rail	**IIIIIIII 1930.** Rolled in 8th month, 1930	**O. H.** Open Hearth			**8625** Heat number may be of four or five figures	**15** Ingot Number	**C** C Rail	
D I & S CO LD · Dominion Iron and Steel Co., Ltd. Sydney, Nova Scotia	**10002** Weight and manufacturers section number	**A·R·A· — A·** A.R.A.—A. Section	**IIIII· 30·** Rolled in 5th month 1930	**O· H·** Open Hearth		**7012** Heat number four figures; first may be a letter	**X** Rollers mark May be a dash instead of a cross	**12** Ingot Number	**B** B Rail
R.E. A.R.E.A. Section	**O.H.** Open Hearth	**10025** Weight and manufacturers section number	**ILLINOIS** Illinois Steel Co. Gary, Ind.	**G.** Gary Works	**IIIII 1930 U. S. A.** Rolled in 5th month, 1930	***** Rolling Mark	**42526** Heat number is always of five figures	**12** Ingot Number	**D** D Rail
R E A.R.E.A. Section	**10025** Weight and manufacturers section number	**O H** Open Hearth	**INLAND** Inland Steel Co. Indiana Harbour, Ind.	**U S A 1930 IIII** Rolled in 4th month, 1930		**15** Ingot Number	✪ Rolling Mark	**21962** Heat number is always of five figures	**C** C Rail
O H Open Hearth	**TENNESSEE —** Tennessee Coal, Iron & Railroad Co., Ensley, Ala.	**10025 —** Weight and manufacturers section number	**R E —** A.R.E.A. Section	**4—1930** Rolled in 4th month, 1930		**6** Ingot Number	**F** F Rail	**840569** Heat number is always of six figures	

NOTE At all mills except Tennessee, the last three figures of the heat number represent the consecutive heat of the furnace identified by the earlier figures. At Tennessee, the last four figures represent the consecutive heat of the furnace.

In the production of special steels, designating letters are usually stamped immediately before or after the heat number, for example: IM or MM for intermediate manganese steel. In some cases. these letters are a part of the brand.

Chart Showing Typical Practice of Branding and Heat Stamping Steel Rails at 10 American Mills

teresting. The sway bracing was heavy and, although not very high, the whole structure was braced longitudinally. The stringers were carried on corbels and were braced against overturning. The width of the bents and length of the caps are particularly noticeable features of the design, as is the absence of the familiar guard rail.

The old bow-string drawbridge shown in the illustration was replaced about 1888 with a lattice steel truss span. The circular stone pivot pier remained in use, however, until 1917, when it was removed to permit the construction of a more modern deck plate girder bridge. We are indebted to R. G. Kenly, chief engineer, for the illustration and the foregoing information.

Branding Rails Aids in Identifying Them

THE SYSTEM of branding rails and stamping the heat numbers in vogue at American steel mills makes it possible to identify every rail in the track as an individual and follow its history through every step of manufacture and test, including its chemical composition and its position in the ingot from which it was rolled. A chart which illustrates the typical practice of 10 rail mills in this respect, corrected to July 1, 1930, is shown on the opposite page. It explains in detail the significance of each of the separate markings in the brand and in the stamping of the heat numbers, which are shown in the exact sequence that is used by each of the mills included in the chart.

The brand appears on one side of the web in raised characters about one inch high and indicates the manufacturer, the mill, the kind of steel, the weight and type of section of the rail, and the month and year it was rolled. The heat stamping appears on the opposite side of the web in depressed characters to indicate the heat number, the furnace from which it was drawn, the ingot number and the position of the rail in the ingot. Since every marker has a definite significance, it is important to find and record all of the markings on the rail when making reports of failed rails.

The brand is rolled into the side of the web as the rail passes through the finishing rolls, so that the characters in the brand of any mill always maintain the same relative positions. Owing to the fact that the heat stamping is set up in a semi-automatic device, there is a varying distance between the identifying figures and letters. Generally, however, the heat number of four to six figures can be identified most easily. The ingot number and the letter designating the position of the rail in the ingot will then be found ahead or back of these figures.

At all of the mills, except that of the Tennessee Coal, Iron & Railroad Company, the last three figures of the heat number represent the consecutive heat of the furnace, which is identified by the earlier figures of this number. Thus, if the heat number is 210025, it indicates that the rail was rolled from heat number 25 drawn from furnace No. 210. At the Tennessee mill the last four figures represent the consecutive heat of the furnace.

In the production of special steels, designating letters are usually stamped immediately preceding or immediately following the heat number, for example: IM or MM to indicate intermediate manganese steel. In some cases, however, these letters are made a part of the brand.

A knowledge of the system of painting and stamping the rail ends as a means of indicating the various classifications which are provided for in the A. R. E. A. specifications for open-hearth steel rails is also important in the identification of rails after failure, but more particularly before they are installed in the track. Briefly, these classifications are indicated in the following manner:

White paint on the ends indicates a No. 2 rail which contains small flaws or other defects; No. 2 rails also have the figure 2 stamped on both ends and are further identified by two prick punch marks on one side of the web back of the bolt holes at each end.

Brown paint on the ends indicates X-Rayls, which are top rails of an ingot which on a representative drop test showed interior defects. These rails also have the letter X stamped on both end faces.

Yellow paint on the ends indicates A rails, which are the top rails of ingots which did not have interior defects that would require these rails to be classed as X-Rayls.

Green paint on the end indicates a No. 1 rail shorter than 39 ft. (No. 2 rails, X-Rayls and A rails that are less than 39 ft. long are not painted green regardless of length.)

Blue paint on the end marks a No. 1 rail, 39 ft. long, with a carbon content above the average of the range specified. (No. 2 rails, X-Rayls, A rails and No. 1 short rails are not painted blue.)

If the ends are not painted, the rail is No. 1, 39 ft. long, having a carbon content less than the average of the range specified.

The foregoing information and the chart are contained in a pamphlet compiled and distributed by the Robert W. Hunt Company, Chicago.

TEN YEARS AGO—The Railroad Labor Board has made an award, granting to railway employees what is probably the largest advance in wages ever made at one time to any class of working men in the world. It is given to about 2,000,000 employees and will, it is estimated, amount to $600,000,000 annually. The average advance to the employees as a whole is about 22 per cent. It amounts to approximately 25 per cent for the maintenance of way empolyees.—*Railway Age*, July 23, 1920.

The Railway Industry at a Glance

Operating revenues and expenses of the Class I steam railways in the United States, from data compiled by the Bureau of Statistics, Interstate Commerce Commission

	Month of May			Five Months Ending With May		
	1930	1929	Decrease, 1930 under 1929, per cent	1930	1929	Decrease, 1930 under 1929 per cent
Total Operating Revenues	$463,130,080	$538,608,395	14.0	$2,246,434,270	$2,534,928,165	11.3
Expenditures for maintenance of way and structures	**70,758,344**	**80,247,425**	**11.8**	**308,748,223**	**334,577,360**	**7.7**
Total operating expenses	351,780,343	391,528,441	10.1	1,738,515,554	1,866,995,431	6.0
Net railway operating income	69,173,723	103,577,559	33.2	307,659,543	457,017,244	32.0

WHAT'S THE ANSWER?

Have you a question you would like to have someone answer?

Have you an answer to any of the questions listed below?

QUESTIONS TO BE ANSWERED IN THE OCTOBER ISSUE

1. *What is the best form of ballast shoulder for the intertrack space on multiple track lines: a level section from end of tie to end of tie, a slightly dipped section, or a V section with definite toe lines?*

2. *What is the most satisfactory design for a wooden floor on an overhead highway bridge carrying heavy automobile traffic?*

3. *What means can be employed to dispose of waste water at water columns quickly to avoid unsatisfactory track conditions?*

4. *What was the reason for the practice formerly followed in some quarters of narrowing the gage of the track through railway crossings? Is this practice still in vogue? If not, why was it discontinued?*

5. *What precautions can be taken in the use of track jacks to avoid creating unsafe conditions?*

6. *What methods should be followed to check meter readings of water that is purchased?*

7. *What is the relative durability of paint applied by brushing as compared with its application by spraying?*

8. *When it becomes necessary to drill holes in stone or concrete to receive anchor bolts, what is the best method of securing the bolts in the holes?*

Keeping Down the Dust

What is the most practical method of keeping down the dust at highway crossings during dry weather?

Clean Ballast Is Most Effective

By Division Engineer

One of the most effective ways to keep dust down at highway crossings is to make certain that the ballast through the crossings is kept clean. Gravel ballast itself is usually dusty in dry weather and this, added to the dust picked up at a dirty crossing, creates an almost unbearable condition, particularly where observation cars are operated. Where the railway is stone ballasted and the ballast through the crossings is kept clean, little or no trouble is experienced, except at crossings with heavily traveled dirt roads. In such cases the dust deposited on the crossing surface by vehicles is picked up by high speed trains.

Several methods have been tried to overcome this nuisance. Not long ago it was a common practice to sprinkle a heavy coat of calcium chloride on the crossing, but this was not wholly effective and has generally been discontinued. Later spraying with crude oil was tried rather widely, but was unsatisfactory, since high speed trains picked up particles of oiled dust and sand and deposited them on the clothing of passengers, causing considerable damage to the garments.

While connected with a southern road some years ago we had a great deal of trouble with Bermuda grass in the ballast. It was quite effective in keeping down the dust, however, since the ballast contained a large amount of fine material. We also found that by planting it at highway crossings we were able to better the dust conditions quite noticeably.

Oiling Gives Best Results

By Engineer Maintenance of Way

Where rock ballast is used there is little or no trouble from dust at crossings with paved highways, except, perhaps, in station grounds. Gravel, cinders, chatts and other fine materials present a problem not only at highway crossings but along the entire roadbed. The greatest nuisance, regardless of the type of ballast, however, is always at the crossings with dirt roads.

The only practical effective remedy for dust wherever it may be found is to blanket it with a coat of heavy oil. The lighter crude oils are nearly useless for this purpose. In order to minimize the trouble, the ballast at the crossing should be clean and the drainage good. If the railway is ballasted with gravel or other dusty material, stone ballast should be applied through the crossing. Stone screenings or gravel should be applied with a binder on the approaches and well rolled, after which the crossing and approaches should be kept well oiled with heavy road oil. It is important that care be used in applying the oil to insure that it does not puddle in the ballast, as churning will occur the same as when saturated with water.

If the approaches cannot be treated in this manner, they should be smoothed down and dragged for 50 ft. to 100 ft. on each side of the tracks. If the earth is dry, it should be sprinkled with water to moisten the surface. While it is damp, but not wet, the oil

should be applied in the manner already described.

If it is not practicable to install stone ballast, the track should be well oiled for two or three rail lengths beyond the crossing. The ballast should be thoroughly dry when this is done. On the less important highways one oiling a year is usually sufficient. When there is more traffic it may be necessary to make one or two light applications to the highway surface later in the season.

Joints in Steel Sheet Piling

Can leakage through the joints of interlocked steel sheet piling be prevented? If so, how?

Cannot Always Be Prevented

By General Inspector of Bridges

Minor leaks through the joints of interlocked steel sheet piling can usually be stopped without much trouble, but sometimes major leaks are not amenable to any ordinary treatment. For minor leaks it is often sufficient to tamp cracked corn or whole wheat into the open space in the joint. As the grain absorbs water it swells enough to resist heavy heads of water, and I have found it effective for heads as high as 47 ft. Even leaks of considerable magnitude often can be stopped in this way.

Where the piling has been driven through gravel or other material sufficiently resistant to distort the joint flanges, this method can seldom if ever be used, since the grain washes out as soon as the current strikes it. I have known several instances of damage in driving where it was necessary to withdraw some of the sections of piling and replace them with undamaged bars in order to get rid of the leaks. In another instance a troublesome leak was stopped by letting the cofferdam fill up to secure still water and then filling the slot in the joint with neat cement. I recall two other instances, one on land and the other in water, where the only recourse was to apply a canvas patch in much the same manner as a hole below the water line in the hull of a ship is closed.

I have in mind still another experience where the leakage could not be stopped, even though the entire cofferdam was withdrawn and redriven with new piling. In this case, which occurred in only 19 ft. of water, a second enclosure was driven outside the normal cofferdam and after excavating the material from between the two lines of sheeting, the space was puddled with clay, with the result that no pumping was necessary.

Depends on Nature of Use

By C. U. Smith
Harbor Terminal Director, Milwaukee, Wis.

The prevention of leakage through the joints of interlocked steel sheet piling depends in large measure upon the use to which the piling is put, upon the manner in which it is driven and the type of sheet pile used. In cofferdam work, Lackawanna sections AP-14, AP-15, SP-12, SP-12b and SP-15 can be leak-proofed successfully, if carefully and properly driven. These sections provide an open hole in the joint which can be filled with dry wheat which should be properly pushed down. When it swells, with the absorption of water, it will seal the joints against leakage.

Sheets driven around a crib can be sealed in this manner, but, if the cofferdam develops leaks from the outside when it is pumped out, there have been instances where such leakage has been stopped by pouring soft coal ashes slowly opposite the point of leakage. If these ashes are not disturbed by jarring or otherwise, and are properly placed, preferably through a pipe, a tight joint will usually result. This method is of very little use, however, when the water is not quiet or is subject to disturbance from time to time.

Leakage Can Be Prevented

By R. A. Van Ness
Bridge Engineer System, Atchison, Topeka & Santa Fe, Chicago

My experience has been that leakage can be practically shut off under a head of water up to 30 ft., or to such an extent that one pump is able to keep a moderate-sized hole dry. For heads greater than 30 ft. the difficulties probably would be materially increased.

The procedure I have observed and which has always been effective in making cofferdams tight is first to pour cinders down in the openings of the interlocking joint, after which cracked corn or whole wheat is pushed down into the holes with a small rod. As the grain absorbs water it expands, tightly compacting the whole mass in the opening. If this is not sufficient to stop the leak entirely, fine cinders are sifted down on the outside of the piling and the current of water going through the opening carries enough of the fine material to assist in stopping the leak. Care must be used in depositing the cinders outside of the sheet piling, however, or they will spread out in the water to such an extent as to be of little value. The efficiency of this part of the operation also depends in large measure on the velocity and direction of the current in the stream as well as upon the velocity of the current through the leak.

Preventing Leaks in Pipes

When laying pipe lines, what precautions can be taken to prevent or minimize leaks at a later date?

Good Materials and Workmanship

By J. A. Russell
Engineer of Water Service, Pennsylvania, Philadelphia, Pa.

Leakage can be minimized or prevented by selecting proper materials for the entire distribution system, giving due regard for all local conditions, including anticipated service conditions and by installing these materials in accordance with accepted good practice.

We are seldom, if ever, justified in using any but the best materials for permanent work. This applies to the entire system. There is no real economy in laying first-class mains and then installing laterals of inferior pipe, with cheap valves and improper stops and wastes. Eventually, inferior materials will fail, with the development of numerous leaks, particularly at joints, valves, etc. Usually, under such conditions, leaks are permitted to continue owing to the high cost and the low economy of repairing them individually, although it is recognized that the total wastage is considerable and that it would be economy to correct the trouble if it were all concentrated at one point. We can seldom show continuous economy by using inferior material. One is very apt to match poor material with poor workmanship.

Good workmanship undoubtedly is the most im-

portant single precaution necessary. Complete standard specifications are highly desirable, but at best, they serve merely as a guide to those responsible for such improvements. Well-laid water-tight pipe lines depend to a considerable extent on good workmanship. It is no job for an amateur, regardless of how simple some phases of it may seem. The skilled workman brings to the job experience based on hard work, broadened by doing just that kind of work for years. No specifications, standard plans or any amount of supervision will replace him.

Given satisfactory material, suitable specifications and skilled workmen, obviously there will be certain features of design that can be controlled in order to minimize subsequent leaks and breaks. The number and length of laterals or service connections should be held to a minimum. Long runs of pipe line supplying facilities which we know will develop water hammer should be prohibited. Large connections, equipped with automatic valves, supplying small tubs or other storage and thus subjected to frequent operation should likewise be prohibited. We should not permit rigid connections between mains and small threaded service lines but should always use lead goosenecks.

In laying screw pipe, insist on good practice in cutting and threading in order to obtain the maximum section at joints. Avoid sharp breaks in line and grade. In laying bell and spigot pipe, eliminate special bends so far as practical by breaking joints for, unless properly backed up, the bends will eventually develop leakage. If bolted or flanged pipe must be used, insist on satisfactory support and some practical means to compensate for inevitable settlement, expansion and contraction. Avoid quick-closing valves of any character. Place an adequate number of automatic air and relief valves, avoiding conditions that will admit air to the pipe lines. Concealed waste lines from relief valves should never be permitted.

All facilities which demand or which should receive maintenance should be installed so as to be easily accessible. Avoid so far as possible conditions that will develop frequent changes in the operating pressure. The entire job from start to finish should be subject to continuous inspection by faithful, competent pipe-line men.

Depends on Character of Pipe Line

By R. C. Bardwell
Superintendent Water Supply, Chesapeake & Ohio, Richmond, Va.

The precautions to be taken when laying pipe lines to prevent or minimize leaks at a later date depend largely on the type or character of the pipe line and the local conditions.

If the pipe is cast iron, the precautions should start at the factory with competent inspection to insure a good quality of pipe complying with the specifications. The handling in loading and unloading should be done carefully to prevent cracking or chipping. In laying, the pipe should have a uniform support under the bottom and should not rest on rocks or similar unyielding objects. Large stones should not be placed adjacent to the pipe in backfilling. Blocking and wedges should be placed under special castings or valves, and curves should be blocked. With bell and spigot pipe, care should be exercised with the yarning as this is the most important feature in securing a tight joint. If lead is used in calking, the quantity should be in accordance with the specifications of the American Water Works Association and it should be calked uniformly around the entire circumference. With composition or cement joints, the manufacturer's instructions should be followed carefully.

The first precaution with wrought iron or steel pipe is to secure uniform good-grade material. Pipe should be installed without strains, and couplings should be taken up the limit on the threads required for the sizes of pipe used. If the pipe line is laid in a locality where the soil or ground conditions are corrosive, clay or some other similar protective substance should be placed around the pipe or one of the various coatings which are on the market should be used, to prevent pitting and other forms of deterioration. Possible electrolysis should also be guarded against.

The conditions and methods outlined are necessarily general, as in all cases the individual situation must be given special consideration.

Concrete vs. Brick Platforms

What are the relative advantages and disadvantages of concrete and brick for station platforms?

Both Have Distinct Advantages

By Arthur L. Sparks
Architect, Missouri-Kansas-Texas, St. Louis, Mo.

There are many distinct and peculiarly favorable advantages in the use of both concrete and brick for station platforms. Each of these materials possesses sufficient merit to place it in a class by itself and thus practically to eliminate competition of one with the other.

Concrete is generally more suited for use in the warmer climates and brick in the colder. The roughened face of the brick not only affords a non-slip surface when covered with frost, snow or ice, but it also provides for expansion and contraction from the more or less constant freezing and thawing of the late winter and early spring.

A well laid brick platform, therefore, is not marred by the unsightly temperature cracks often seen in concrete, which also prove to be vulnerable points for rapid wear resulting from the use of iron-wheeled baggage and express trucks. Brick platforms are much more easily and quickly repaired or resurfaced with little hindrance to operation. Brick laid flat in herringbone or basket-weave patterns on a well-tamped sand fill are easily removed. New sand can be tamped in the low places and the brick brought to a true surface without any extra time being required for hardening.

A single broken brick can be removed immediately and a new one inserted by any janitor or station employee, thereby preventing further wear. Brick can be removed quickly and replaced without the necessity for ordering new material in the event of frozen water lines or stopped sewer or drain lines. The brick can be easily formed or shaped to a warped surface without special tools or expert workmen.

On the other hand, concrete provides a homogeneous surface more perfectly drained and is practically indispensable when a watertight surface is required. It provides an opportunity for architectural treatment and is generally used in connection with buildings of monumental or ornamental type. It can be finished with a highly polished surface or it may be finished

with a top containing carborundum, making a non-skid surface. It may be marked off into geometrical patterns with colored borders and centers if so desired.

It provides a smoother surface over which to truck baggage, express and mail, making it possible to pile the trucks higher without danger of having the loads shaken off on account of vibration, as is sometimes the case with brick platforms. Concrete is more suitable for use on slopes and ramps as brick has a tendency to "crawl" and kick out under such conditions.

For a first-class job it is essential that either type of platform be provided with adequate drainage and with substantial concrete curbs of sufficient depth to extend below frost. Down spouts should not be permitted to waste on to the platforms, no matter what material is used in their construction.

Either Material May Be Satisfactory

By Engineer of Buildings

Some maintenance officers not only raise no objection to brick platforms, but recommend them without hesitation, although they do not favor the use of concrete platforms for passenger stations, except at the most important terminals, on the ground that possible changes in grade or alinement will result in a complete loss of the investment they represent, since they contain no material that can be salvaged. While this may be true in particular instances, to a considerable extent the same argument will apply to the brick platform, since a large part of its cost is that of labor, which obviously cannot be salvaged when the facility is abandoned. As a rule, brick platforms constructed in recent years have concrete curbs which normally have no salvage value; the same is true of the earth or cinder filling, while the sand cushion is seldom worth what it will cost to save it. The brick then constitutes the only part of the structure that does have a salvage value, and it represents only a minor part of the original cost.

As a matter of fact, the percentage of the total number of station platforms for the railways as a whole, or even for any particular railway, which within the life of either type, will be affected by such changes is negligible except in certain sections where it is known that line or grade revision is imminent. For this reason, the comparison between the two forms of construction should be made on the basis of cost, the amount of maintenance required and the service which may be expected of them.

Assuming that the new platform is to replace a wooden one or is being built on a site not previously occupied, the cost of constructing the curb and placing and ramming the filling material is substantially the same in either case. The spreading and leveling of the sand cushion may increase the cost of the brick platform slightly, although brick can usually be laid cheaper than concrete can be placed and finished. In some instances, therefore, one type will cost more than the other, while in other cases, the reverse may be true, depending on the relative cost of the materials delivered on the site of the work.

Barring damage from accident, the average brick platform requires considerably more maintenance than a well-constructed concrete platform, although, when repairs are needed, the cost for the latter is generally much higher. In general, the cost of maintaining concrete platforms is negligible, whereas the necessity for resurfacing brick platforms recurs constantly. It is my observation that the total cost of maintaining a brick platform, over the period of the life of a concrete platform, will be far greater than the cost of maintaining the latter.

When new, brick presents a rough non-slip surface and rarely becomes slippery from wear. When covered with frost or a slight coating of ice, however, brick platforms become very slippery, and this is considerably increased if the surface is uneven. Because it is difficult to maintain a smooth surface, considerably greater effort is required to pull baggage and express trucks over brick platforms, while the danger of shaking part of the load off is ever present.

Concrete platforms can be finished with an even surface that is smooth or rough as desired. If an abrasive material, such as carborundum, is used in the finishing coat, a non-slip surface is produced which is entirely satisfactory. Because of the evenness of the surface, less effort is required to propel station trucks which can be more heavily loaded without danger of shaking off part of the load.

There are many places where brick platforms can be installed to advantage, while in others concrete platforms will prove more satisfactory. The question of possible changes should not control the decision as to type, unless it is known that such changes are probable, in which event a more temporary type of construction may be advisable. Every case presents its own particular problem and the decision as between the two types should be based on a full consideration of all the factors involved.

Effect of Canting Rails

What effect, if any, does the canting of rails have on the development and growth of transverse fissures?

May Delay the Development of Fissures

By C. B. Bronson
Assistant Inspecting Engineer, New York Central, New York

The New York Central lines adopted as standard, in 1925, a tie plate giving a cant of 1 in 44 for all sections of rail. For about 10 years prior to that date one of the roads constituting this system had used tie plates to give the rail a cant of 1 in 20. After an exhaustive study of tie plate design, however, particularly with reference to the proper amount of cant, it was decided that the inclination of 1 in 44 gives the most nearly correct relationship obtainable between the rail head contact surface and the wheel contour.

It is quite noticeable that where this design of tie plate is in use, the coverage on the rail head is better than where the rails are laid with their axes vertical. There is much less distortion of the gage corner at the top of the rail head, while the better bearing of the wheels on the running surface of the rail gives a more satisfactory distribution of the wear on this surface.

We have no statistics that indicate any increase in the number or in the rate of growth of interior transverse fissures in rails that are supported on canted tie plates. What we are noticing, however, is that the nuclei of the fissures that do develop are now farther away from the gage side of the rail, being located more often directly above the outside line of the web of the rail. This change in the position of the nuclei apparently results from the fact that the

center of pressure of the wheel bearing has been moved outward on the rails that are canted.

There is an interior zone of metal in the rail head which is likely to be somewhat brittle in certain rails or to contain shatter cracks. The nuclei of fissures may be in any part of this interior area, but generally they are found to be located with reference to the maximum intensity of pressure developed by the wheel contacts. The strip of brighter metal on the top of the head indicates the area over which this maximum pressure is applied.

While we do not believe that canted rail will eliminate transverse fissures in rail heads, we do consider that the better relationship which is thus established between the contour of the head and the wheel contacts will lengthen the time before such fissures will develop, and our experience up to this time indicates that this view is correct.

Does Not Believe There Is Any Effect

By J. Morgan
Supervisor, Central of Georgia, Leeds, Ala.

I have had many years experience in maintaining track under widely varied conditions and with rail sections ranging from 56-lb. to 90-lb. It has been my observation that transverse fissures are as likely to develop on tangents as on curves, although on curves the greater number seem to occur in the low rail, this being the only difference so far as location is concerned. It is our practice to use canted tie plates on curves only, with a few minor exceptions. Since the development of transverse fissures seems to occur in about equal proportion in the canted and vertical rails, this would indicate that the canted tie plates have no influence on the number of such fissures. I have no data, however, upon which to base a conclusion as to the relative rate of growth of individual transverse fissures, once they have begun to form.

What seems to me to be an important fact in this connection is that practically all of the transverse fissures which have come under my observation have occurred in 90-lb. rail. I have seen a few in rails weighing 80 lb. to the yard, but I have never seen such a defect in rails of lighter section, even after many years of service. Another fact which I have noticed is that the standard of maintenance does not have any part in the formation of transverse fissures since they occur with equal frequency in well maintained track and in track where the maintenance is at a low standard.

There Is No Way of Knowing

By Engineer of Tests

Since no positive information bearing on this subject is in existence, it would seem that the question can be answered in a speculative manner only. It has been indicated quite definitely that the so-called shatter cracks that are sometimes found in rail steel are the initial cause of at least many of the transverse fissures which eventually develop. What factors determine whether any particular crack will develop into such a fissure, and, if it does, how fast it will grow has not yet been discovered.

The farthest progress that has been made along these lines has been to assemble certain facts concerning the growth of particular fissures which it has been possible to put under observation. Since our present information indicates that the properties of the rail steel in the immediate vicinity of the shatter cracks, the condition of the roadbed and the general service conditions which the rail must withstand, all enter into the question of growth, there are too many variables involved to make it possible to single out one roadbed condition and say what, if any, effect it has on the inception or growth of transverse fissures.

One might expect on the average that transverse fissures in canted rails would be more centrally located in the head than those in rails laid with their axes vertical. This is only a surmise, however, since no substantiating facts have been developed. In fact, I do not see what benefit would be derived from a determination of this point.

Safety in Tie Renewals

In renewing ties, what precautions should be taken to avoid injury to the men engaged in this work?

Every Operation Should Be Watched Carefully

By G. H. Warfel
Assistant to General Manager, Union Pacific, Omaha, Neb.

Presumably this query refers only to the specific operation of tie renewal, and does not include the unloading and distribution of ties. A preliminary precaution is, of course, the actual distribution of every tie at the roadside as near as possible to the point where it will be put in the track. In removing old ties and putting in new ties, men usually work in pairs. Foremen should see that these pairs are kept at least four or five ties apart, to prevent interference with each other.

The men must be taught that a pick is a dangerous tool, and that any man using it must be watchful to avoid striking other men, either in front of him or immediately back of him. They should be trained not to go close to a man using a pick, and never to drop tools or toss them aside without looking to see that no one is in the way. The same instructions apply to the use of a spike maul or a sledge in knocking the old tie over into the trench before removal. Do not permit shovel blades to be used in spearing a tie and dragging it out of the track. If the tie is very soft or rotten, a sharp pick is even safer than tie tongs to drag out the old tie.

Pick points must be kept sharp. Some foremen keep an extra sharp pick for use only for dragging out ties and do not allow it to be dulled by picking in ballast. One pick for this special use may serve a small section gang. Whether a pick or a tie tong is used in dragging the tie out, the men should be taught not to stand backed up against the rail when pulling, but have the rail in front of them, so that, if the tool slips, they will not fall over the rail. They should also keep one leg back to avoid falling, if the tool slips. If the tool is firmly anchored in the tie, slipping is minimized.

When a new tie has to be carried to position, those carrying it should keep well away from other men and not throw it down close to other men until they have been warned and have stepped out of the way. A tie tong with single sharp spurs should be used for dragging the tie along the ground and also for dragging it into the trench for application. If a tong is not available, a sharp pick may be used but with more damage to the tie. Never use a shovel for this purpose. Men are frequently injured by taking hold of a tie with their hands to help guide and pull it into place under the rails, while their partner is

pulling on the further end with a pick or tie tong. The man using the tool should always work in the trench on the end of the tie nearest the rails, and, if a man is assisting him with bare hands, the latter should handle the outer end of the tie farthest away from the rail. This precaution will avoid the pinching and mashing of many fingers between the tie and the rail.

When old ties are dragged out, the men should be required to carry them beyond the ditch and to gather up any pieces to avoid creating a stumbling hazard. Keep tools out from under foot as much as practicable. In this connection, the report of the Non-Train Accident committee of the Safety Section, A.R.A., in April, 1929, Section B-5, also Section B-3, on removing and applying spikes and tie plates, contains detailed suggestions which should be in the hands of every responsible maintenance officer.

Definite Rules and Proper Training

By J. J. Hess
General Roadmaster, Great Northern, Seattle, Wash.

Simple as it may seem to casual observation, every operation connected with tie renewals presents some element of danger, but these can be minimized or even eliminated by proper training of both foremen and laborers and constant supervision to insure that instructions are being followed consistently. It is customary to remove the old ties and insert the new ones by hand, the men working in pairs to do this. From the standpoints of both efficiency and safety the new ties should be placed in position at right angles to the rail approximately at the points where they are to be applied, in advance of the actual renewal.

While the old ties are being removed and the new ties inserted, the rail should be raised slightly with jacks to avoid binding the ties. One man should stand outside the rail and pull the old tie out with a pick having a well-sharpened point which has been embedded deeply in the wood to prevent slipping. The second man should stand at the other end and use a lining bar to dislodge and guide it; neither a shovel nor the bare hands should ever be used for this purpose. The old tie should be disposed of immediately by removing it far enough from the track to insure that other workmen will not stumble over it or that it will not interfere with later operations, including the unloading of ballast.

After the bed has been cleaned and leveled off, one man should stand at the forward end of the new tie and pull it into place with tie tongs. Picks or shovels should never be used in this operation. The second man should take the farther end in his hands to lift and guide it into place.

There are several "don'ts" which have an important place in the instructions covering proper practices in tie renewals. Always use a jack to lift the rail; never spring it with a clawbar or lining bar. Never permit a shovel to be used for pulling out an old tie or pulling in a new one. Use a well-sharpened pick for pulling out the old tie, but always use tie tongs with sharp spurs for pulling in new ones. The use of picks definitely shortens the life of the tie and, if it is creosoted, the pick is very likely to slip as soon as the pull is exerted. Tools should never be thrown down promiscuously or in the way of other workmen. When casting ties, planking or other material, one man should be designated to give the word so that the motions of both of them can be synchronized.

Keep the men paired and keep the pairs well separated to avoid interference, one pair with another; a rail length makes a convenient interval. When necessary for other workmen to pass, they should watch carefully to avoid being struck by tools. The men engaged in the handling of the ties have their attention centered on their work and may not notice that any one is passing.

All of the instructions in the world are of no value unless they be obeyed. Safety requires constant education in and practice of the rules laid down for the guidance of the foremen and men. As already intimated, the renewal of ties seems to be a simple operation, yet many injuries occur while it is being done. A foreman should instruct his men what to do and how to do it, and then insist that these instructions be obeyed, calling immediate attention to any infraction of the rules, no matter how slight.

Direction to Surface Track

In reballasting on multiple tracks, should the surfacing be done with or against the traffic? Why?

Favors Surfacing With the Traffic

By J. Morgan
Supervisor, Central of Georgia, Leeds, Ala.

There is practically no difference from a safety standpoint between surfacing with and against the current of traffic during a reballasting operation. There are several other features involved, however, such as convenience of doing the work, the riding conditions of the track, possible damage to equipment and the sensations aroused in the passengers on fast trains. Taking all of these into consideration, it is my opinion that the surfacing, when any considerable lift is involved, should be done with the traffic.

I think no one will deny that the riding conditions are better when dropping down on a runoff than when the train is being lifted over one. The sensation received by passengers is not as disturbing and there is less danger of broken springs or other damage to equipment, particularly if there is considerable difference in the elevation of the new grade line and the old track. For these reasons a shorter runoff can be used in surfacing with the traffic, thus permitting a larger amount of productive time for the gang, especially if the number of trains which must be cared for is large.

Surface Against the Current of Traffic

By E. P. Safford
Supervisor of Track, New York Central, Silver Creek, N. Y.

I am of the opinion that the best results are obtained, when surfacing out of face, if the track raising is done against the current of traffic. This practice tends in large measure to reduce the danger of the track kicking out in hot weather, particularly if the rail is tight or the temperature is rising rapidly. It is of the utmost importance, however, when raising track to make sure that there is sufficient joint expansion and that no open joints are frozen, but that the tension in the bolts is such that they will readily "take up."

If the track is being raised against the current of traffic, the joints ahead of the jacks can be loosened without danger since the rail anchors on the undisturbed track will permit a backward movement only, so that there is no danger of crowding the jacks or of

a forward movement of the track as a whole which might result in serious kinking of the rails.

Many track foremen prefer to raise track with the traffic, on the ground that a shorter runoff can be used with safety when the train is dropping than when it is being lifted to meet the new grade. This may be true, but in my opinion short runoffs are to be avoided generally. In any event, the safety feature of holding the track in its original position far outweighs the advantage of the shorter runoff. The added advantage of keeping the expansion uniform by the former method is sufficient to condemn the practice of working with the traffic.

Inside Metal Guard Rails

Where some effective method of spacing ties is provided, is the inside metal guard rail a satisfactory substitute for the outside guard rail for open-deck bridges? Does it have any additional advantages? How does the type of structure—through or deck steel spans or ballast-deck trestle—affect the value of its use?

No Other Effective Tie Spacer

By G. A. Haggander

Bridge Engineer, Chicago, Burlington & Quincy, Chicago

The question apparently is based on the assumption that there is an effective method of spacing ties on open-deck bridges other than by means of an outside timber guard rail. I have never heard of a method which I consider as effective for this purpose as the outside wooden guard rail. It is our practice to use for this purpose an 8-in. by 8-in. timber, fastened to every tie by means of a lag screw, ¾ in. by 10 in., except that a bolt is used through the ties and guard rail at each end of every length of timber.

If some other effective method of spacing the ties can be developed, I would prefer the inside metal guard rail as I think it is more effective than the outside wooden guard rail in guiding derailed cars over the structure. On a deck structure the inner metal guard rail will prevent the wheels from going so far out on the ends of the ties that they are likely to break, while on a through span it prevents the cars from getting far enough out to foul the girders or trusses.

On a ballast-deck bridge, I consider that the outer guard rail, which is little more than a ballast retainer, does very little good in case of a derailment, since it does not project very far above the ballast. On such bridges, inside metal guard rails furnish far greater protection.

Our present practice is to install inside metal guard rails on all through bridges and on deck bridges where there is great danger of derailment. This is not a substitute for the outer guard rail, but an additional precaution, since in all such cases we retain the outer wooden guard rail, primarily as a tie spacer.

Inside Metal Guard Rail Is More Effective

By Superintendent of Bridges

The outside wooden guard rail as used at present serves two distinct and widely different purposes; to space the ties and to guide the wheels of derailed cars so that they will not go out far enough to fall off deck bridges or strike the members of through spans. Up to the present no satisfactory substitute for the first function has been developed. The only published suggestion of a substitute method of tie spacing which I can recall is the one presented in a monograph by the Committee on Wooden Bridges and Trestles at the recent convention of the American Railway Engineering Association. The device by which it was proposed to accomplish this was not described, except to say that it is of non-combustible material. No mention was made of the proposed method of fastening it in place, and the drawings to which reference was made were of the most general character.

It seems probable that a satisfactory method of spacing ties can be developed, but, because of the simplicity and effectiveness of the present method, it does not appear that anyone has tried seriously to do so. For this reason, although the question furnishes plenty of food for thought, the assumption that there is a substitute method that is effective seems to be a little ahead of the times. Admitting the assumption to be correct, however, and passing to the second function, I am definitely of the opinion that the inside metal guard rail is superior to the outside wooden guard rail.

This superiority was first called to my attention a number of years ago by two derailments on bridges having gauntlets. In both cases the derailments occurred at the frogs of the gauntlet as a result of brake shoes wedging in the flangeway of the frogs. In both cases the wheels were guided by the adjacent rail of the gauntlet, which fulfilled the same function as an inside guard rail, so that the heavily loaded cars remained upright and practically in line. In one of these instances 31 cars of grain, badly overloaded, were derailed. The train was running at high speed and the derailed cars continued to move across the bridge until all of the six through truss spans were occupied by 29 of the cars. The train did not stop until the coupling broke when the wheels of the leading derailed car bunched the ties and settled into the ballast at the far end of the bridge. From many later observations I am sure that a wooden guard rail would not have shown the same effectiveness.

In one state at least, the law requires the use of inside metal guard rails on all openings where the continuity of the embankment is broken. In the monograph already referred to, the use of light rail was advocated to reduce the cost of the installations. My experience indicates that this would be a serious mistake. The guard rail should be of the same or practically the same height as the running rail, to be most effective. I have seen several instances where wheels rode over low guard rails, but have never seen a case where this happened with guard rails of the same height as the running rail.

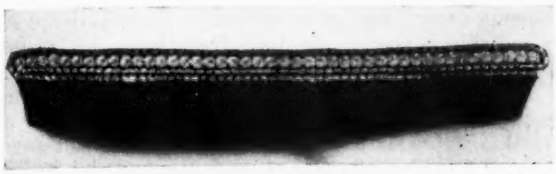
Derailments are likely to occur at any place and from a wide variety of causes. For this reason, I would make no distinction as to the type of structure—through or deck steel spans, ballast-deck or open-deck timber bridges or concrete bridges—to be protected by inside metal guard rails. The damage to any one of these structures, as well as to the equipment and lading, may be so great that the cost of the better protection afforded by the inside metal guard rail should be considered as a low-priced high-grade insurance.

Fifty Years Ago—The New York Central & Hudson River (now the New York Central) has adopted the automatic air brake for installation on its rolling stock, and has given orders for the equipment of its passenger cars. This road is almost the last of the large railroads of the country to adopt an air brake.—*Railroad Gazette*, July 23, 1880.

New And Improved Devices

Strengthen Continuous Belts

THE endless-cord belt which has been the standard transmission on several motor cars of Fairmont Railway Motors, Inc., Fairmont, Minn., since 1925, has recently been improved and strengthened by placing two plies of rubberized fabric the full width of the belt on the side which comes in contact

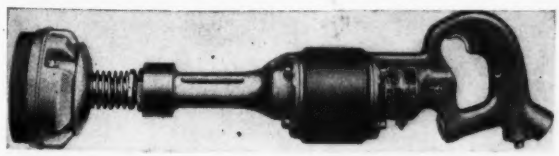


A Cross-Section of the Improved Belt, Showing the Construction of the Endless-Cord Core

with the engine and axle pulleys. This new feature is said to double the resistance to wear of the belt and to give greater protection to the endless-cord core which carries the load. As shown in the illustration, this core is formed by a continuous cord which is wrapped lengthwise of the belt and is solidly embedded in rubber.

Tool Grinder Adapted to Surfacing Concrete

A PORTABLE pneumatic concrete surfacer, known as the CP No. 88 rotary concrete surfacer, which is adapted for finishing and smoothing concrete, marble, granite and similar materials, has been developed by the Chicago Pneumatic Tool Company, New York. It is an adaptation of the CP No. 88 portable pneumatic tool grinder which was described in the January issue. It is said to be particularly well adapted to rounding corners and edges and bringing stone to a highly polished surface. The



The CP No. 88 Rotary Concrete Surfacer

adaptation was accomplished by the substitution of various forms of smoothing wheels and cutting tools for the grinding tool and, except for the tools and the tool housing, is similar in all details to the No. 88 grinder. It is provided with a pistol grip and rotates at a speed of 4,250 r.p.m. The overall length is 21½ in. and the weight is 23 lb. Anyone of three wheels of different surfacing characteristics is available; the No. 20 wheel which is rough, the No. 80 wheel which is medium, and the F wheel which is fine. Extra equipment consists of a buffer and a Berg surfacer.

New Power Rail Drill Developed by Nordberg

A POWER rail drill that contains a number of advantageous features has been developed and placed on the market by the Nordberg Manufacturing Company, Milwaukee, Wis. This drill is powered by a 2½-hp. air-cooled gasoline engine and weighs about 350 lb. The engine drives a reducing gear through a friction clutch which permits the drill to be stopped instantly without shutting down the engine. Power is transmitted to the drill spindle by means of a double roller chain and the spindle is provided with feed gears which give it four adjustments of feed. These feeds permit the selection of the

The New Nordberg Power Rail Drill

proper feed for any size of drill bit, from the smallest to the largest ordinarily used in track work. The drill has a hand feed lever by the use of which the drill bit is moved forward to the point of drilling, after which the feed pawl is dropped into place and the feed becomes automatic.

This equipment is attached to the rail by means of a removable clamp which can be dropped into position instantly. This clamp has two arms, each of which has three notches on its under side. One of the notches on each arm engages the short round bar which is provided on each side of the frame of the drill chuck, to hold the machine firmly to the rail. With this arrangement of notches, the distance of the equipment from the rail may be adjusted according to the length of the drill bit and the size of the rail.

An adjusting screw with a flat base which rests against the ties is located at the same end of the ma-

chine as the drill. This screw allows the machine to be raised or lowered quickly to secure the proper position of the bit with reference to the hole to be drilled. It is claimed that this equipment will drill holes within 2¼-in. of the end of a rail.

This equipment is provided with a double-flanged roller which is normally held in the raised position, but when the machine is to be wheeled from one place to another a pin is withdrawn, allowing the roller to drop down and bear on the rail. For short distances the machine can be carried by means of the long tubular handles which are provided for this purpose, while for longer distances it can be wheeled. The frame of this drill is made entirely of steel of both plate and rolled sections welded together. It is said to be exceedingly simple and rugged in construction and capable of operation by the ordinary laborer found in track and extra gangs.

Syntron Develops New Screw-Spike Driver

A NEW electric screw-spike driver has been developed and is now being placed on the market by the Syntron Company, Pittsburgh, Pa., for attaching tie plates to the ties. This tool weighs 70 lb., is powered with an electric motor, and is equipped with

One of the Screw-Spike Drivers in Use with One of the Drills in the Background

two long bar handles for two-man operation. These handles are about waist high, thus, it is said, allowing the operators to work in an upright and natural position.

The motor is geared down to a slow speed and the tool is equipped with a friction clutch that slips when the spike has been run down against the tie plate to the proper tension. The adjustment of the clutch is such that it releases when the tension is sufficient to draw the tie plate firmly against the tie, and yet is not great enough to strip the threads in the wood. The tool is equipped with an automatic trigger switch that cuts the current off when released, and it also has a reversible switch for reversing the direction of rotation of the driver when it is desired to back the spikes out of the ties. It is said that this equipment will drive a ⅞-in. screw spike down in approximately five to six seconds, and that, during continuous operation, an average of from five to six spikes can be driven per minute.

An electric drill, which was designed especially to

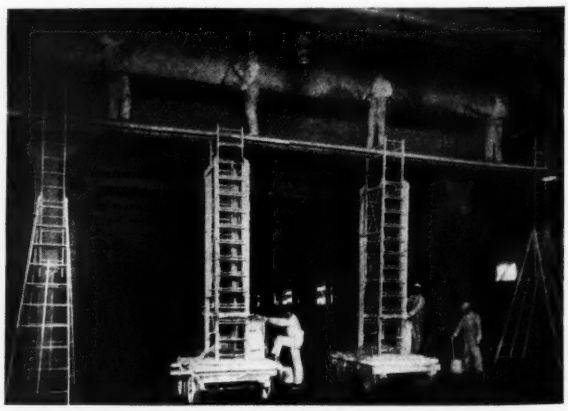
The Tools Are Powered from a Small Tie Tamper Power Plant

drill holes in ties in connection with the use of these screw spike drivers, has also been developed. This drill has a two-speed transmission feature which includes a low speed that is desirable for exceptionally hard, treated ties. It weighs about 30 lb. and it is said that it can be handled easily and continuously by one man without fatigue. This drill is of full ball-bearing design and of extra-heavy construction. A ¾-in. ship auger is used to bore holes for ⅞-in. screw spikes.

Two of the screw-spike drivers and four of the ¾-in. electric wood drills can be powered from a small portable six-tool tie-tamper power plant. Power is carried from the power plant to the tools by means of a 500-ft. two-conductor cable. Within 50 ft. of the tools, the cable is split into separate lines for each tool. This arrangement allows a range of operation of 1,000 ft. for each set-up of the power plant and a working radius of 100 ft. between the tools.

A Portland Cement Paint for Concrete Surfaces

APPROXIMATELY 15 acres of the surfaces of the concrete columns, beams, and walls in the recently completed Cleveland, Ohio, union passenger terminal have been covered by a portland cement paint, known as Medusa portland cement paint, which is manufactured by the Medusa Portland Cement Company, Cleveland, Ohio. This paint, which has a portland cement base, is manufactured in the form of a white powder and is mixed with water before being applied. It is applied by either brush or paint spraying equipment. By use of the latter its application to rough masonry and rough finished



Medusa Portland Cement Paint Being Applied to Concrete Surfaces in the New Cleveland Union Terminal

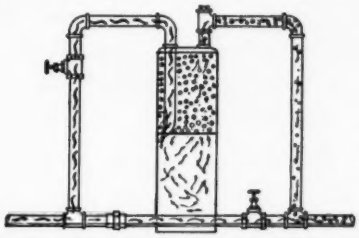
portland cement stucco surfaces is greatly facilitated.

This paint forms a permanent bond with concrete surfaces and it is claimed that, when properly applied, it is not affected by the chemical action of lime or alkalies and that it will not peel, scale, chip or dust off. When applied to any exterior or interior concrete surface this paint forms a durable, attractive coating and at the same time is said to retard the penetration of moisture.

This paint is manufactured in white, blue, green, cream, stone gray, pearl gray and red. Ten pounds of the paint is sufficient to cover from 200 to 350 sq. ft. of surface in one application. The outstanding feature of the paint is the fact that it may be applied to wet or fresh concrete and masonry surfaces without the application of neutralizing agents. The concrete surface to which Medusa paint is to be applied needs no other preparation than that necessary for the application of an ordinary concrete wash. Foreign material such as dirt, dust and any whitish efflorescence that may be present is removed and the surface then wet down with water. The latter process prevents the porous surface from drawing from the paint the water which is necessary for its proper hydration.

A New Anti-Freeze for Compressed-Air Equipment

THE Sullivan Machinery Company, Chicago, has placed on the market a product known as Tannergas which, when used in connection with Tanner-tanks, is said to prevent the freezing of compressed-air lines and at the exhaust of compressed-air tools at extremely low temperatures. This equipment consists of the Tanner-tank which contains the Tannergas in liquid form and which is provided with a system of pipes to allow it to be connected to the air line near the point of use, in the form of a by-pass. Through this by-pass, by means of appropriately located valves, a large quantity of the air is



A Diagram Showing the Manner in Which the Air Is Mixed with the Liquid to Form Tannergas

caused to flow, while a smaller quantity continues in the air line. This arrangement is said to prevent dilution of the liquid in the tank and at the same time to allow sufficient air in the main air line to carry the moisture. As the air comes in contact with the liquid in the tank, Tannergas is released to mix with the air that is flowing out of the tank and back to the main air line. From this point it is said that none of the air lines or air tools will freeze, and that the gas does not settle in the low places of the line but is blown with the air into every crack and crevice, saturating all the moisture in the line and the tools.

It is claimed that Tannergas is harmless, odorless and non-explosive and that it does not affect lubrication, hose, gaskets, metal or the paint in spray guns. No alteration in existing equipment is said to be required for the installation of this equipment.

New Books

Proceedings of the American Wood-Preservers' Association. 592 pages, illustrated, 6 in. by 9 in. Bound in cloth. Published by the Association, 1104 Chandler Building, Washington, D. C. Price $6.

This volume contains the proceedings of the twenty-sixth annual meeting which was held at Seattle, Wash., on January 28-30. At this meeting 36 papers and committee reports were presented, all of which are published in full in this volume. Among the papers were one on the Use of Treated Douglas Fir on the Pacific Lines of the Southern Pacific Company, by F. D. Mattos, manager treating plants, Southern Pacific, West Oakland, Cal.; another on the Use of Creosoted Douglas Fir Piles and Timber in Dock and Bridge Construction, by R. J. Middleton, assistant chief engineer, Chicago, Milwaukee, St. Paul & Pacific, Seattle, Wash.; a third on Zinc Chloride as a Wood Preservative, by L. C. Drefahl, chemist, Grasselli Chemical Company, Cleveland, Ohio; and another on the Preservative Treatment of Engelmann Spruce Ties, by J. D. MacLean, senior engineer, Forest Products Laboratory, Madison, Wis. Among the committee reports of special interest to railway officers were those on Tie Service Records, Pole Service Records and the Treatment of Car Lumber.

The book also contains the twentieth annual compilation of statistics on the quantity of wood treated and preservatives used in the United States for the year 1928, a compendium of 22 pages. This was prepared by R. K. Helphenstine of the U. S. Department of Agriculture, in co-operation with the American Wood Preserver's Association.

A feature which is introduced in these proceedings for the first time is an index of all of the proceedings published by the association to date, 1905 to 1929, inclusive. This index, which comprises 64 pages, is a carefully prepared bibliography of all topics considered by the association, arranged for ready reference. It is the intention of the association to revise this index and bring it up to date at five-year intervals. This volume, in common with its predecessors, constitutes the most comprehensive literature on the progress of timber preservation and is edited to the customary high standards of this association.

Handbook of Culvert and Drainage Practice. 349 pages. illustrated. 4½ in. by 7 in. Bound in flexible imitation leather cover. Published by the Armco Culvert Manufacturers Association, Middletown, Ohio. Price $2.

This volume contains valuable information and data on the many and varied phases of the drainage problem. It includes a large amount of engineering data on the design of culverts, including a considerable number of extracts from authoritative technical reports and records. Space is also given to the tabulation of cost data on the installation of different types of culverts.

Space is also devoted to information on the problem of determining the sizes of culvert openings and ascertaining the proper length and location of culverts. The jacking method of providing drainage openings is explained, and the subject of sub-surface drainage is treated liberally, the book containing a chapter on the railway applications of subdrainage. One chapter discusses the types, causes, and cures of landslides and much space is devoted to instructions covering the installation of corrugated metal pipe. Tables in the back of the book contain a large amount of valuable information.

WITH THE ASSOCIATIONS

Bridge and Building Association

The work of the year is rapidly rounding up for the convention, three of the eight committees having already completed their work and turned their reports in to the secretary. The other reports are in progress and are expected to be completed in the near future, insuring that they will all be available for printing in advance of the convention.

American Railway Engineering Association

Five committees held meetings during the month of July. The Committee on Masonry held a two-day meeting at Buffalo on July 16 and 17; the Committee on Yards and Terminals met at Toronto, Ont., on July 14; the Track committee at White Sulphur Springs, W. Va., on July 21 and 22; the Iron and Steel Structures committee at Montreal, Que., on July 24 and 25 and the Committee on Rules and Organization at Niagara Falls on July 25 and 26.

The Proceedings for 1930 have been printed and are now in the bindery. They will be mailed early in August. With a total of 1,858 pages, this year's proceedings will be one of the largest in the history of the organization.

Approximately 1,200 copies of the 1929 Manual, which came off the press about two months ago, have been sold. An innovation in making the standards of the association available has been authorized by the Board of Direction, whereby individual chapters of the Manual, bound in plain white paper, may be had without the need for purchasing the entire volume. The price for these individual chapters ranges from $1 to $2.

The first bulletin to be published subsequent to the annual convention is now on the press, this issue containing the addresses of the banquet speakers, a monograph and several pages of association news.

Roadmasters' Association

The Executive committee of the Roadmasters' Association held a meeting at the Hotel Stevens, Chicago, on Saturday, June 28, with an attendance of 15, including officers and directors and the chairmen of the five standing committees that are to present reports at the convention in September. The primary purpose of this meeting was to afford an opportunity to review the present status of the committee work, all five chairmen presenting preliminary drafts of their reports which indicated that, in general, excellent progress has been made in the committee work.

In addition, considerable time was devoted to a rounding out of the convention program, including the selection of speakers to present papers and addresses, supplementing the reports of committees. A short joint session was held with officers of the Track Supply Association for the purpose of considering definite arrangements for the conduct of the convention.

Track Supply Association

A total of 59 firms have already applied for 82 spaces up to July 25 for the exhibit of track materials and equipment that will be presented under the auspices of the Track Supply Association at the Hotel Stevens, Chicago, on September 16-18, coincident with the convention of the Roadmasters' Association, thereby assuring a larger and more representative exhibit than at any previous convention. As space is now being assigned in the order of receipt of applications, those companies which have not yet made arrangements for the display of their products should apply promptly to L. C. Ryan, secretary of the Track Supply Association, Oxweld Railroad Service Company, 230 North Michigan Avenue, Chicago.

The companies which have applied for space to date are as follows:

Achuff Railway Supply Company
American Chain Company
American Fork & Hoe Company
American Hoist & Derrick Company
American Steel & Wire Company
American Valve & Meter Company
Bethlehem Steel Company
Buda Company
Caterpillar Tractor Company
Chipman Chemical Engineering Company
Creepcheck Company
Crerar, Adams & Co.
Cullen-Friestedt Company
Duff-Norton Manufacturing Company
Electric Tamper & Equipment Company
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Hayes Track Appliance Company
Hopkins Company
Hubbard & Co.
Industrial Brownhoist Corporation
Ingersoll-Rand Company
O. F. Jordan Company
Kalamazoo Railway Supply Company
Keystone Grinder & Manufacturing Company
Koppel Industrial Car & Equipment Company
Lundie Engineering Corporation
Maintenance Equipment Company
Mechanical Manufacuring Company
Morrison Railway Supply Company
National Carbide Sales Corporation
National Lock Washer Company
Nordberg Manufacturing Company
Northwestern Motor Company
Oxweld Railroad Service Company
P. & M. Company
Pettibone-Mulliken Company
Pocket List of Railroad Officials
Positive Rail Anchor Company
Q. & C. Company
Rail Joint Company
Railroad Supply Company
Railway Engineering & Maintenance
Railway Maintenance Corporation
Railway Purchases & Stores
Ramapo Ajax Corporation
Reade Manufacturing Company
Reliance Manufacturing Company
Republic Steel Corporation
Sellers Manufacturing Company
Skelton Shovel Company
Standard Oil Company of Indiana
Syntron Company
Templeton, Kenly & Co., Ltd.
Union Switch & Signal Company
Warren Tool & Forge Company
Western Wheeled Scraper Company
Woodings Forge & Tool Company
Woolery Machine Company

Party at Outing of Metropolitan Track Supervisor's Club at East Norwalk, Conn., June 14

RAILWAY NEWS BRIEFLY TOLD

Boeing Air Transport, Inc., has established 20-hr., day and night, passenger air service between Chicago and San Francisco, Cal. The fare between these points, which is $200, is based on a charge of about 10 cents a mile and includes transportation to and from air ports and meals while en route.

Employment statistics of Class I railways for the month of May, which have been issued by the Interstate Commerce Commission in its preliminary report, show a total of 1,601,494 employees as of the middle of the month, a decrease of 6.59 per cent as compared with May, 1929, and a decrease of 6.33 per cent as compared with May, 1928.

The Supreme Court of California on July 1 denied the petition of the Southern Pacific, the Los Angeles & Salt Lake and the Atchison, Topeka & Santa Fe, for a rehearing of the court's recent order upholding a decision of the Railroad Commission of California in which these carriers were directed to proceed with the construction of a union passenger station at Los Angeles.

The United States Senate on July 1 passed the resolution introduced by Senator Howell of Nebraska providing for the appointment of a committee of three senators to investigate the operations, economic situation and prospects of the Alaska Railroad, and to report to Congress with recommendations for legislation. Senators Thomas of Idaho, Kendrick of Wyoming and Howell, have been appointed members of the committee.

A 1,400-ft. double-track tunnel on the Chesapeake & Ohio was recently converted into an open cut after about ten months of practically continuous excavating operations, during which about 700,000 cu. yd. of material was removed. The open cut, which is situated on the main line of the C. & O. at Ona, W. Va., about 13 miles east of Huntington, is said to be the fourth largest railway cut in this country, being 112 ft. deep and 300 ft. wide at the top.

Examiner W. A. Disque of the Interstate Commerce Commission has recommended in a proposed report that the commission authorize the Southern Pacific and its steamship lines to adjust their rates so as to be able to compete for some of the traffic now being handled by water lines through the Panama canal, by granting fourth section relief on substantially all carload traffic of the kind carried by the steamship lines between New York and Baltimore piers and points in California, via the Sunset-Gulf ocean-and-rail route through Galveston, Tex., or Houston. The report proposes to allow this road to place in effect rates, many of which would be less than half of the present rates, without reducing rates to intermediate points.

Carload shipments of the 29 principal commodities in the third quarter of 1930, as estimated by the shippers' regional advisory boards, will be approximately 8,806,716 cars, a reduction of 613,603 cars, or 6.5 per cent, as compared with those of the corresponding period of 1929. All of the 13 regional advisory boards anticipate reductions in transportation requirements for the third quarter of the year compared with the same period last year, but increases are anticipated for 9 of the 29 principal commodities.

During the recent meeting of the Safety Section of the American Railway Association at Denver, Colo., statistics were presented which showed that the railways have already far exceeded the 35 per cent reduction in accidents which was set in 1924 as the goal for the end of 1930. It was reported at the meeting that, in respect to all accidents, there were 889 fewer persons killed and 94,717 fewer persons injured in railroad accidents in 1929 than in 1923, a reduction on all counts of 53 per cent.

The Confederation of the Canadian National, which operates between Toronto, Ont., and Vancouver, B. C., has been equipped with lounge cars with a miniature gymnasium, an ice cream parlor, baths, barber shop, valet service and orthophonic and radio entertainment. This new car is 84 ft. 7½ in. long and 12 of them will be used in the service. The exercise room contains vibratone and Swedish massage machines as well as foot and hand exercising apparatus. The window panes are made of vita glass which permits the passage of ultra-violet rays of light.

Employees of the Pennsylvania have greatly over-subscribed the allotment of 360,000 shares of stock that they were given the opportunity to purchase this spring at par, which is $50 a share. The stock has been selling in the market at upwards of $70. According to A. J. County, vice-president, employees applying for from 1 to 7 shares are to receive the full amount subscribed, while those applying for from 8 to 20 shares are to receive 7 shares each. All stock is to be paid for on the installment plan by monthly payroll deductions of $2, $5 or $10 per share, at the option of the employee.

R. H. Aishton, president of the American Railway Association, estimates that if all the cars that were loaded last year were placed in a solid train and hooked up with sufficient motive power, it would require 1,000,000 locomotives and a similar number of caboose cars to house the train crew necessary to handle the train. The crew would be three times as large as the entire population of Chicago. There would be 10,000 miles of locomotives, 390,730 miles of train and 5,685 miles of caboose cars, an over-all length of 406,417 miles. Routed west through Chicago and reported on block at 7 a. m. when traveling 30 miles per hour, it would require approximately 564 days and 11 hours to clear the block after having wrapped itself around the world 16 times en route.

A total of 932 proceedings, involving the elimination of 1,561 railroad grade crossings in New York state outside of New York city, have been started by the Public Service Commission of New York since the elimination of such crossings was begun under the present law some time ago. A report of the work up to July 1 of this year shows that the commission has held a total of 2,355 hearings on grade crossing cases; has approved the completed work of 417 projects involving the elimination of 540 crossings, and has issued 453 additional orders for the elimination of 792 more crossings, on which work, estimated to cost more than $108,000,000, is in progress or about to begin.

I. C. C. Rate Decisions

During July, the Interstate Commerce Commission handed down two freight rate decisions, one of which, according to the commission, will increase the revenues of the roads in western trunk line territory by 10 or 12 million dollars yearly, while the other is estimated to reduce the revenues of western roads at least 15 million dollars annually. The former decision involves the readjustment of class rates in western trunk line territory, effective November 1, and was made as the result of petitions filed by the roads five years ago. The latter decision orders reductions in grain rates throughout western territory and to the principal seaports, effective October 1.

Construction News

Projects Contemplated

A. T. & S. F.—Has presented plan to Board of City Directors, Pasadena, Cal., for elimination 40 street crossings, double tracking through city, and construction two passenger stations and freight station, $6,930,000.

B. & O.—Has applied for federal permit to build river and rail terminal, Pittsburgh, Pa., on Monongahela river, about 6.7 miles above mouth; includes loading pier, mooring pile clusters and ice breakers; will handle 50 loaded and 50 empty cars at one time.

C. N. R.—Has made agreement with city of Regina, Sask., for construction of freight line on outskirts of city, $500,000.

C. B. & Q.—Together with Mo. State Highway Com. has applied to Pub. Serv. Com. of Mo. for permission to construct reinforced concrete viaduct over Highway No. 71, Buchanan county, $31,000.

C. R. I. & P.—Has applied to I. C. C. for authority to construct 4.7-mile extension, Dallas, Tex.

C. R. I. & P.-St. L. S. W.—Agree to lay 9 miles track to serve reclaimed area of Trinity River levee district, Dallas, Tex.; C. R. I. & P., 6 miles, $200,000; St. L. S. W., 3 miles $150,000.

Houston & Tex. Cent.—Has applied to I. C. C. for authority to construct 5-mile extension, Harris County, Tex.

Monessen Southwestern—Subsidiary of Pittsburgh Steel Co.; plans to construct line between Monessen, Pa., and Bellevernon, $1,000,000.

Nat. of Mex.—To construct new central passenger station, Mexico, D. F., to serve all lines entering city, $9,600,000.

N. Y. C.—With Mich. Cent. has applied to I. C. C. for permission to construct 7.25-mile extension, Grand Rapids, Mich.

Oconee & Deepstep—Has applied to I. C. C. for authority to construct line between Oconee, Ga., and Campbell, 9 miles.

Q. O. & K. C.—With Mo. State Highway Com, plans construction two grade separation structures, Lewis county, Mo., at State Highway No. 6, $40,000.

U. P.—Construction of line from Las Vegas, Nev., to Boulder Dam site in Black Canyon, 35 miles, to haul materials and supplies to dam site.

Approved by Commissions

D. & H.—Plans and estimate of cost of $114,838 for elimination grade crossing, Warren st., Queensbury, N. Y.; for construction overhead bridge to eliminate Coopersville station crossing on Chazy-Rouses Point state highway, Champlain, N. Y., $42,500; for elimination Elsmere-Bethlehem Center county highway crossing, Bethlehem, N. Y.; and for elimination West Main st. and Ryder and Washington ave. grade grossings, Cobleskill, N. Y., all approved by Pub. Serv. Com. of N. Y.

Erie—Plans for elimination grade crossing on Lakeville-East Avon highway, Avon, N. Y., approved by Pub. Serv. Com. of N. Y.; elimination Liberty st. crossing, Endicott, N. Y., also approved by Com. Amended order of Com. provides for elimination two crossings, Goshen, N. Y., and diversion of traffic to grade separation structure, $159,000; also eliminate grade crossings, Big Flats and Horsehead, approved by commission.

Erie-L. V.—By Pub. Serv. Com. of N. Y. to reconstruct bridges carrying tracks over Waverly-Oswego highway, Tioga, N. Y., cost to roads, $64,000.

Erie-L. V.-D. L. & W.—Plans and cost of $106,200 for elimination Ely road and Williamsville road crossings, Depew, N. Y., approved by Pub. Serv. Com. of N. Y.

G. N.-W. P.—By I. C. C. to construct 200 miles new line; G. N. between Klamath Falls, Ore., and Bieber, Cal., 88 miles; W. P. between Keddie, Cal., and Bieber, 112 miles. Total cost $13,636,796, of which $10,066,176 is W. P. portion and $3,570,620 is G. N. portion. Also authorized to construct or acquire jointly line between Lookout, Cal., and Hambone, 36 miles.

Long Island—Plans for elimination Deer Park ave. and Half Hollow grade crossings, Deer Park Station, Babylon, N. Y., approved by Pub. Serv. Com. of N. Y.

M.-K.-T.—By War Dept. to construct bridge over Missouri river, Boonville, Mo.

N. Y. C.—General plans for elimination Cemetery crossing on Canton-Potsdam state highway, Canton, N. Y.; detailed plans for elimination Albion st. crossing, Murray, N. Y.; revised plans for elimination Genesee st. crossing, Cheektowaga, N. Y.; estimate of $92,500 for construction approaches for elimination Watkins-Yates county line state highway crossing, Reading, N. Y.; plans for elimination Nichols ave. grade crossing, Syracuse, N. Y., and Ballentine road grade crossing, Forestport, N. Y.; and general plan for elimination Phelps st. crossing, Adams, N. Y., all approved by Pub. Serv. Com. of N. Y.

Penna.—Pub. Serv. Com. of N. Y. has approved plans for construction highway bridge, Sherman, N. Y., for elimination Osborne, Hitcomb and Shreve crossings.

S. L.-S. F.—By city authorities of St. Louis, Mo., to construct four-track, reinforced concrete and steel structure over Southwest ave. at Ivanhoe ave., St. Louis, $123,800.

S. P.—Morgan's Louis. & Tex. and Tex. & New Orleans, subsidiaries, authorized by I. C. C. to construct two extensions, Lockport, La., 10.4 miles, $100,912.

Projects Authorized

A. T. & S. F.-C. B. & Q.—Plans approved for construction reinforced concrete viaduct on Pennsylvania ave., Leavenworth, Kan., $35,000.

C. P. R.—To replace present bridge at M. P. 17 on Moosehead subdivision, Onawa, Me., with steel viaduct, 1,180 ft. long, 123 ft. high, with river span of 208 ft.; also to renew bridge at M. P. 28.3, same subdivision, across Wilson stream with steel viaduct, 870 ft. long and 120 ft. high, with deck-truss span of 160 ft.; both on concrete piers, total $950,000.

L. V.—To erect 15-story freight terminal and warehouse on west side Manhattan Island, ground floor to be used as freight terminal for L. V. and other floors for general industrial purposes. Will contain 25,000,000 cu. ft. storage space and 1,750,000 sq. ft. floor area.

L. & N.—Has prepared plans for underpass at Caroline st. and viaduct at 19th st. and is preparing plans for underpass at 40th st., Covington, Ky.

M. P.—Is preparing plans for reinforced concrete viaduct at 6th and Bond sts., Little Rock, Ark., $100,000.

N. Y. C.—Has made agreement with State of New York to reconstruct viaduct at River st., Nelliston, N. Y., $90,000.

Bids Received

G. N.-W. P.—For construction joint line, between Klamath Falls, Ore., and Keddie, Cal., 200 miles.

S. L.-S. F.—Construction of viaduct, Old Orchard, St. Louis county, Mo., $20,000.

Contracts Awarded

A. T. & S. F.—Construction 1,900-ft deck girder bridge over Rio Grande river, Presidio, Tex.—List Const. Co., Kansas City, Mo.; construction substructure, including 17 piers, new bridge across South Canadian river, 20 miles north Amarillo, Tex.—Union Bridge & Const. Co., Kansas City, Mo., $1,000,000. Will be 1,736 ft. long and 114 ft. above river.

C. N. R.—Two-story addition to station, Calgary, Alta., to house telegraph facilities—Bennett & White, Calgary, $35,000; and construction 6-story, reinforced concrete warehouse, Montreal, Que.—Atlas Const. Co.

C. & O.—Construction passenger station, additional parking tracks and other improvements, White Sulphur Springs, W. Va.—Ward & Ward Co., White Sulphur Springs, $170,000; construction single-track Alleghany tunnel, 4,550 ft. long, 86 ft. north of and parallel to existing tunnel—Walton Const. Co., Roanoke, Va. Old double-track tunnel to be relined and converted to single-track tunnel, $1,660,000; also construction water treating station, Seth, W. Va.—Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa. Construction 3,168-ft., concrete-lined, single-track tunnel to parallel present single-track Lewis tunnel, 15 miles west of Covington, Va.—Bates & Rogers Const. Co., Chicago, $1,100,000.

C. B. & Q.—Construction 200,000-bu. reinforced concrete addition to grain elevator, Council Bluffs, Iowa—Burrell Engr. & Const. Co.

C. M. St. P. & P.—Construction 2,000,000-bu. addition to elevator, Milwaukee, Wis.—James Stewart Corp., Chicago, $250,000.

C. R. I. & P.—S. L.-S. F.—Construction union passenger station, Oklahoma City, Okla.—Tankersly Construction Company, Oklahoma City, $575,000.

Dayton & Union—Construction reinforced concrete retaining walls, abutments and culverts for elevation Penna. tracks between Bainbridge and Detroit sts., Dayton, Ohio—Bates & Rogers Construction Company, Chicago, $197,678.

Erie-D. L. & W.—Construction approaches in connection with elimination grade crossings, Painted Post, N. Y.—William L. Collins, Hornell, N. Y., $168,368.

Ky. & Ind. Term.—Elevation tracks, Louisville, Ky.—Henry Bickel Co., Louisville, $270,000.

L. & N.—Construction power plant, Howell, Ind.—Platoff & Bush, Louisville, Ky., $35,000.

M-K-T.—Construction substructure for Missouri river bridge, Boonville, Mo.—Kansas City Bridge Co., Kansas City, Mo.

M. P.—Construction bridge over Ouachita river, Arkadelphia, Ark.—List & Weatherly Construction Company, $150,000.

N. Y. C.—Construction foundations and abutments, and completion viaduct, West End ave. and West 65th, New York.—H. H. Sherwin & Co., Inc., New York; construction duct lines and splicing chambers between 140th st. and Hudson River Division crossing, New York—Edward J. Duffy Co., Inc., New York; construction two sheet-metal covered storehouses, Port Morris, N. Y.—Miller-Blyth, Inc., New York; demolition buildings on Charlton, King, West and Washington sts., New York—Markley Contr. Co., New York; Construction highway to eliminate existing crossing at Boxhart st., Rochester, N. Y.—Dempsey & Ballard, Inc., Syracuse, N. Y.; elimination Main st. grade crossing, New Hamburg, N. Y.—Walsh Const. Co., Syracuse, N. Y.; reconstruction bridge F-156, Knowlesville, N. Y.—William J. Gallagher, Medina, N. Y.; and reconstruction bridge carrying Medina-Albion state highway over tracks, Ridgway, N. Y.—William J. Gallagher, $66,474.

Penna.—Removal train shed at passenger station, Columbus, Ohio—Ferro Const. Co., Chicago; also construction undergrade bridge, Middle River, Baltimore county, Md.—McNichol Paving & Construction Co., Philadelphia, Pa., $25,000.

St. L.-S. F.—Construction three reinforced concrete and steel platform shelters, 600 ft. long, Tulsa, Okla.—Manhattan Const. Co.; construction of platforms at same location, Reid & Lowe.

Term. Ry. Assn. St. Louis.—Construction of 800-ft. reinforced concrete viaduct, Broadway ave., Venice, Ill., $500,000.

Wab.—Construction reinforced concrete viaduct to carry Union and Lindell blvds. over Wab. and C. R. I. & P. joint tracks, Forest Park, St. Louis, Mo.—R. J. Blackburn, Incorporated, $131,600.

Supply Trade News

General

The Prest-O-Lite Company, Inc., New York, has opened a new plant for the manufacture and distribution of dissolved acetylene at Casper, Wyo.

The Wilson Welder & Metals Company, Inc., North Bergen, N. J., moved its offices and plant on July 21 to its new building at 956-970 Thirty-eighth street, west of Bergen Turnpike.

The Independent Pneumatic Tool Company, Chicago, has opened a branch sales office at 6200 East Slauson avenue, Los Angeles, Cal. **Vernon Job,** formerly manager of the San Francisco (Cal.) office, is in charge of the new office and is being assisted by **B. J. Herron.**

Tube-Turns, Inc., Louisville, Ky., has appointed the following companies as distributors of its products: **The Grinnel Company,** Charlotte, N. C.; **Ebbert & Kirkman Company, Inc.,** Birmingham, Ala.; the **B. Hoffmann Manufacturing Company,** Milwaukee, Wis.; the **United Pipe & Supply Company,** Charleston, W. Va.; the **Vulcan Copper & Supply Company,** Cincinnati, Ohio; and **Hedley & Voisinet,** Buffalo, N. Y.

Personal

R. J. Welsh, Atlanta, Ga., has been appointed a representative of the **Chicago Pump Company,** Chicago.

Otis B. Duncan, Chicago, has been appointed a representative of the **Rawls Manufacturing Company,** Streator, Ill.

J. C. Baxter, vice-president of **A. Guthrie & Co.,** St. Paul, Minn., at New York, has resigned to become connected with **Carey & Kennedy,** New York. The name of the latter contracting firm has been changed to **Carey, Baxter & Kennedy.**

H. H. Peasance, formerly general sales manager of the steel bar division of the **Bourne-Fuller Company,** Cleveland, Ohio, has been appointed district sales manager of the **Republic Steel Corporation,** Youngstown, Ohio, with headquarters at Indianapolis, Ind.

Stuart R. Ives, vice-president and general manager of the **Lyle Culvert & Pipe Company,** Minneapolis, Minn., has been appointed general manager of the **Armco Culvert Manufacturers Association,** with headquarters at Middletown, Ohio. Previous to joining the staff of the Lyle Culvert & Pipe Company early in 1929, Mr. Ives was connected with the American Rolling Mill Company for 13 years, of which 10 years were spent in the culvert and flume department and 7 years as manager of that department.

B. Cheacock, first vice-president of the **Caterpillar Tractor Company,** has been elected president, succeeding **A. C. Force,** who has been elected chairman of the executive committee of that company. Headquarters of the operating personnel, which are now located at San Leandro, Cal., will be moved to Peoria, Ill., and all tractor manufacturing will be concentrated at the latter point, releasing the facilities at San Leandro for research work.

Standard Equipments, Inc., a new railroad supply company, has been organized by New York and Canadian interests, with the following officers: **C. O. Bradshaw,** president; **R. F. Greenwood,** vice-president and engineer; **J. E. Ingram, Jr.,** vice-president; and **J. H. Rogers,** secretary and treasurer. This company, which has its main office at 415 Lexington avenue, New York, and a branch office in Montreal, Que., is specializing in the manufacture and distribution of the Evertite rail joint. Mr. Bradshaw, president of the new company, who will have headquarters at New York, has a long background of railway experience. He entered railway service in the maintenance-of-way department of the Chicago, Burlington & Quincy in 1900, and in July, 1902, left that road to accept a position with the Great Northern, where he remained until February, 1917, having been in this period an officer in both the transportation and maintenance departments. From February, 1917, to December, 1917, he served on the Special Committee of National Defense of the American Railway Association, at Washington, D. C., and then resigned to enter the service of the Chicago, Milwaukee & St. Paul. Mr. Bradshaw was with this road until January 1, 1928, having held the positions of superintendent, general superintendent, assistant general manager and general manager. During the years 1918 and 1919, while serving as general superintendent on the Milwaukee, he also served as terminal manager for the United States Railroad Administration in the Milwaukee district. On January 1, 1928, he left the Milwaukee to accept the position of vice-president of the Robinson Automatic Connector Company, New York, which position he still retains.

C. O. Bradshaw

Personal Mention

General

J. S. Bassett, assistant superintendent of the Arkansas division of the Missouri Pacific, with headquarters at Little Rock, Ark., and formerly division engineer at the same point, has been appointed acting superintendent with the same headquarters.

Leverett S. Miller, president of the New York, Westchester & Boston, a subsidiary of the New York, New Haven & Hartford, who obtained his early railway training in the engineering and maintenance of way fields, retired on July 1, at his own request. **John J. Pelley,** president of the New York,

Leverett S. Miller

New Haven & Hartford, whose early training also embraced a number of years as supervisor and roadmaster on the Illinois Central, will assume the position as president of the N. Y. W. & B. in addition to his present duties.

Mr. Miller was born on May 23, 1863, at New York and was educated in private schools and at Rensselaer Polytechnic Institute, Troy, N. Y., receiving a degree in civil engineering from the latter in 1885. Later in the same year he entered railway service as engineer of maintenance on the Denver, Utah & Pacific (now part of the Chicago, Burlington & Quincy). Since then he has served as engineer of the Colorado Railway; chief engineer of the Alabama Eastern; assistant resident engineer of the Thames River Bridge at New London, Conn.; assistant superintendent on the New York, Providence & Boston (now part of the N. Y. N. H. & H.); chief engineer and later assistant general manager of the St. Paul & Duluth (now part of the Northern Pacific); one of the receivers of the Washington Central; manager of the Seattle & International (also part of the N. P.); assistant to the president of the Erie; general manager of the Tennessee Construction Company; and general manager of the Central New England (now part of the New Haven), resigning from the latter position in May, 1909, to accept the presidency of the New York, Westchester & Boston, with headquarters at New York, where he remained until his retirement.

Lorenzo Perez Castro, who was recently appointed executive vice-president of the National Railways of Mexico, with headquarters at Mexico, D. F., is an engineer by training and experience. He was born in Mexico, D. F., on April 18, 1878, and received his early scholastic training in the same city. He finished his studies at the National Preparatory School at the age of 18 years and completed his professional work at the National School of Engineers, Mexico, at the age of 21 years. Between the time of his graduation, in 1899, and 1901, when he was granted the title of civil engineer, Mr. Perez Castro was engaged in various engineering projects. From 1902 until 1913, he was connected with the Secretary of Communication and Public Works of Mexico, devoting his attention to various railway projects as a technical inspector. In this period he was also in charge of a number of

Leorenzo Perez Castro

hydraulic works and assistant professor of practical topography of the National School of Engineers at Tlaxco, Tlax. During 1914, he was inspector of interlocking plants and assistant engineer maintenance of way of the National Railways, and in November, 1915, he became secretary of the board of directors of those railways. In March, 1916, he was appointed engineer of bridges, becoming chief of the bureau of industries under the secretary of industry, commerce and labor in July, 1917, a position he retained until February, 1925. In February, 1925, he was appointed chief of the traffic and concession bureau under the secretary of communications and public works. On June 1, 1929, Mr. Perez Castro was commissioned to make a valuation of damage to railway property occasioned by the military operations of March, 1929. This work was interrupted in August, 1929, by his selection to make a study of European railroads, chiefly Belgian and German, for the commission charged with developing an administrative and financial plan for the National Railways. Upon his return to Mexico, he was appointed advisor to this commission and in May, 1930, he was appointed assistant to the executive vice-president of the National Railways, his election as executive vice-president becoming effective on June 13.

Aless J. Loom, assistant superintendent of timber preservation and tie treating plants of the Northern Pacific, at Paradise, Mont., has been promoted to general superintendent of timber preservation, with headquarters at Brainerd, Minn., succeeding **Andrew Gibson,** who retired from active duty on July 1. **George Hopkins,** assistant to the general superintendent of timber preservation at Seattle, Wash., has been promoted to assistant general superintendent, succeeding Mr. Loom. **Levi Johnson,** assistant at Paradise, has been appointed superintendent of the Brainerd treating plant.

Mr. Gibson has been connected with the Northern Pacific for 47 years. He was born on June 16, 1860, at Rossshire, Scotland, and attended the Tain Royal Academy in that country until 1879. He first entered railway service in this country in 1883 as a chainman on the construction of the Northern Pacific line between Portland, Ore., and Kalama, Wash. Until 1888, he served successively as chainman, rodman, levelman and transitman on location in the Cascade mountains, and in that year he was promoted to assistant engineer in charge of lining the Stampede tunnel with masonry, and later he was in charge of bridge filling on the Pacific division. From 1898 to 1902, he served as assistant engineer in charge of branch line construction in Montana,

Andrew Gibson

Idaho and Washington, and also in charge of dock construction at Seattle, Wash. Mr. Gibson was promoted to superintendent of the Yellowstone division in April, 1902, and in April, 1905, he was transferred to the Rock Mountain division. He was promoted to superintendent of timber preservation and tie-treating plants in August, 1907, and in June, 1911, he was appointed engineer maintenance of way of the lines east of Paradise, Mont., being re-

appointed superintendent of timber preservation and tie-treating plants in May, 1917, which position he held until his recent retirement.

Mr. Loom was born at Motley, Minn., on April 23, 1887. He completed his public school work at Motley in 1904 and for the following two years attended a business college at Minneapolis, Minn. He entered railway service in April, 1906, as a yard clerk on the Northern Pacific at Brainerd and in the following year he was advanced to chief yard clerk. In 1908, he was transferred to the engineering department as a timekeeper and yard clerk in the tie-treating plant at Brainerd. Four years later Mr. Loom was promoted to yard foreman of the plant, becoming assistant superintendent of timber preservation and tie treating plants, with headquarters at Paradise, Mont., in 1919, which position he held until his recent promotion, effective July 1.

Engineering

H. D. Barnes, assistant engineer on the Chicago & North Western, has been appointed cost engineer, with headquarters as before at Chicago.

G. R. Jenkins, resident engineer on the Chesapeake & Ohio, with headquarters at Clifton Forge, W. Va., has been transferred to Surveyor, W. Va., in charge of construction of the Marsh Fork branch.

As a result of the abolition of the Ontario division of the New York Central, which took effect on July 1, **P. L. Barker,** division engineer of that division, with headquarters at Oswego, N. Y., has been transferred to the St. Lawrence division, with headquarters at Watertown, N. Y.

E. P. Whitson and **R. A. Wood,** assistant division engineers on the Gulf, Colorado & Santa Fe (part of the Atchison, Topeka & Santa Fe), with headquarters at Cleburne, Tex., and Beaumont, respectively, have been assigned to other duties and the position of assistant division engineer at each of these points has been abolished.

The system engineering offices of the Seaboard Air Line, including those of **W. D. Faucette,** chief engineer; **J. B. McClain,** engineer bridges; **J. C. Williams,** engineer buildings; and **J. L. Kirby,** engineer maintenance of way, which are now located at Savannah, Ga., will be moved to Norfolk, Va., about August 1.

J. B. Bell, track supervisor on the New Haven division of the New York, New Haven & Hartford, with headquarters at Putnam, Conn., has been promoted to division engineer of the Boston division with headquarters at South Station, Boston, Mass., succeeding **T. P. Polson,** who has been promoted to maintenance engineer with headquarters at New York, succeeding **C. F. Yardley.** Mr. Polson's jurisdiction extends over the New York division of the New Haven, the New York Connecting Railroad, and the New York, Westchester & Boston.

Tauno Pajari, instrumentman on the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Minneapolis, Minn., has been promoted to assistant to the division engineer of the Iowa & Dakota division, with headquarters at Mason City, Iowa, to succeed **S. E. Kvenberg,** whose appointment as assistant to the general supervisor of bridges and buildings is noted elsewhere in these columns.

C. J. Swane, division engineer on the Northern Montana division of the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Lewistown, Mont., has been transferred to Milwaukee, Wis., to replace **C. F. Allen,** who has been assigned to other duties. The Northern Montana division has been consolidated with the Rocky Mountain division and **D. C. Rhynsburger,** division engineer of the latter, with headquarters at Deer Lodge, Mont., has had his jurisdiction extended to include the Northern Montana division. **L. R. Boettcher,** division engineer of the Wisconsin Valley division, with headquarters at Wausau, Wis., has been transferred to the Racine & Southwestern division, with headquarters at Beloit, Wis., to replace **C. Holland,** who has been assigned to other duties. The Wisconsin Valley division has been consolidated with the La Crosse division and **G. K. Farner,** division engineer of the latter, with headquarters at Portage, Wis., now has jurisdiction over both divisions. **F. R. King,** formerly division engineer of Portage, Wis., who has been on leave of absence, has been appointed division engineer of the Madison division, with headquarters at Madison, Wis., to succeed **B. V. Burtch,** who has been assigned to other duties.

H. W. Routenberg, assistant division engineer on the Baltimore & Ohio, with headquarters at Baltimore, Md., has been promoted to assistant engineer maintenance of way and structures, with the same headquarters, to succeed **T. H. Gordon,** whose death is noted elsewhere in these columns. Mr. Routenberg was born on February 2, 1885, at Wyandotte, Mich., and received his higher education at the Sheffield Scientific School of Yale University. He entered railway service in August, 1909, with the Boston Elevated Railway in the subway construction department. In April, 1910, he went with the Pennsylvania, Lines West, as assistant on the engineer corps, with headquarters at Cleveland, Ohio, and in September, 1912, he became engineer of maintenance and construction of the Lakeside & Marblehead Railroad, with headquarters at Marblehead, Ohio. In September, 1915, he entered the service of the Baltimore & Ohio as assistant supervisor, with headquarters at Wilmington, Del., and in June, 1918, he was promoted to assistant division engineer, with headquarters at Philadelphia, Pa. In June, 1919, he was transferred to Keyser, W. Va., and in August of the same year he became a levelman, with headquarters at Gassaway, W. Va. In November of that same year he was appointed transitman, with headquarters at Baltimore, and in June, 1920, he was promoted to assistant division engineer, with the same headquarters, which position he was holding at the time of his recent promotion to assistant engineer maintenance of way and structures.

Track

D. McCooe, superintendent of track on the Canadian National, with headquarters at Toronto, Ont., has retired after 32 years' service with that road. The position of superintendent of track has been discontinued.

O. O. Osborn, assistant engineer on the Chicago, Indianapolis & Louisville (the Monon), has been promoted to roadmaster, with headquarers at Lafayette, Ind., to replace **B. Rohrabaugh,** whose death is noted elsewhere in these columns.

C. D. Prentice, assistant supervisor on the New York, New Haven & Hartford, has been promoted to supervisor of track on the New Haven division, with headquarters at Putnam, Conn., succeeding **J. B. Bell,** whose promotion to division engineer is noted elsewhere in these columns.

Elmer Witzel, levelman on the Baltimore & Ohio, with headquarters at Weston, W. Va., has been promoted to supervisor, with headquarters at Parkersburg, W. Va., to succeed **P. C. Laign,** who has been transferred to Clarksburg, W. Va., where he relieves **R. E. Zepp,** who has been transferred to Philadelphia, Pa.

L. F. Bird, assistant on the engineer corps of the Cincinnati division of the Pennsylvania, has been appointed acting track supervisor on the same division, to replace **T. B. Greene,** who has been appointed acting supervisor, with headquarters at Hamilton, Ohio, where he succeeds **R. W. Riser,** who has been transferred to Xenia, Ohio, to relieve **T. J. Binkley,** who has been assigned to other duties.

A. T. Darnell, general track inspector on the Gulf, Colorado & Santa Fe (part of the Atchison, Topeka & Santa Fe), with headquarters at Cleburne, Tex., has been appointed roadmaster on the Northern division, with the same headquarters, to succeed **B. F. Myers,** who succeeds **S. E. Rich** as roadmaster at Cleburne. Mr. Rich has been assigned to other duties.

A. J. Dillard, roadmaster on the Panhandle & Santa Fe (part of the Atchison, Topeka & Santa Fe), with headquarters at Slaton, Tex., has been transferred to Lubbock, Tex. **D. C. Cage,** roadmaster at San Angelo, Tex., has also been transferred to Lubbock and **H. L. Sandlin,** roadmaster, with

headquarters at Plainview, Tex., has been transferred to San Angelo to replace Mr. Cage.

R. Dennis, roadmaster on the Dauphin division of the Canadian National, with headquarters at Hudson Bay Jct., has been transferred to Swan River, Man. **G. Brown** has been appointed roadmaster of the Melville division, with headquarters at Melville, Sask., to succeed **A. Shack**, whose transfer to Saskatoon, Sask., was noted in the July issue. **W. J. Marchen**, roadmaster on the Dauphin division, with headquarters at Kamsack, Sask., has been transferred to Dauphin, Man., on the same division.

Alexander Hallisey, whose promotion to roadmaster on the Southern Pacific was announced in the July issue, was born on January 12, 1886, in Ireland. He first engaged in railway work in this country on May 20, 1907, as a trackman on the Southern Pacific, retaining this position until January, 1909, when he was advanced to assistant track foreman and relief foreman. In July, 1910, Mr. Hallisey was further promoted to extra gang foreman, serving in this position and as track foreman until March 1 of this year, when he was advanced to roadmaster at Suisun, Cal.

W. W. Clarke, whose promotion to supervisor of track on the Pennsylvania, with headquarters at Marion, Ohio, was noted in the July issue, was born on November 18, 1893, at Hopkinsville, Ky., and attended the University of Kentucky, from which he graduated with a degree in civil engineering in 1916. Almost immediately after graduating he entered the service of the Pennsylvania as an assistant on the engineer corps of the Logansport division. On January 1, 1927, Mr. Clarke was promoted to assistant supervisor of Subdivision No. 2 of the Indianapolis division, with headquarters at Columbus, Ind., and seven months later he was transferred to Subdivision No. 1 of the same division, at Louisville, Ky. On September 26, 1928, he was appointed acting supervisor on Subdivision No. 3 of the Toledo division, with headquarters at Marion, which position he held until his recent promotion.

Bridge and Building

F. A. Brown, general foreman of carpenters on the Pennsylvania, with headquarters at Trenton, N. J., has retired from active duty.

S. E. Kvenberg, assistant to the division engineer of the Iowa & Dakota division of the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Mason City, Iowa, has been appointed assistant to the general supervisor of bridges and buildings, with headquarters at Chicago.

Elliott E. Candee, supervisor of bridges and buildings on the Waterbury division of the New York, New Haven & Hartford, with headquarters at Waterbury, Conn., has retired after 45 years of active service with that road.

In connection with the abolition of the Ontario division of the New York Central, which became effective on July 1, **L. W. Stone**, supervisor of bridges and buildings on that division, with headquarters at Oswego, N. Y., has been transferred to the St. Lawrence division, with headquarters at Watertown, N. Y.

F. R. Benedict has been appointed assistant bridge and building supervisor on the Union Pacific, with headquarters at Omaha, Neb., to replace **P. R. Glassburn**, who has been promoted to bridge and building supervisor, with headquarters at Marysville, Kan., where he succeeds **George T. Ray.**

H. Wright, supervisor of bridges and buildings of the Central division of the Missouri Pacific, has had his jurisdiction extended to include the Southern Kansas division which was recently consolidated with the Central division. **W. C. Webster**, supervisor of bridges and buildings of the Southern Kansas division, with headquarters at Coffeyville, Kan., has been appointed assistant supervisor of bridges and buildings of the new division, with the same headquarters.

Obituary

F. M. Clough, supervisor of bridges and buildings on the Southern Pacific, with headquarters at El Paso, Tex., died in July.

D. H. Mahoney, retired supervisor on the Baltimore & Ohio, died on April 11, at Vincennes, Ind., at the age of 75 years.

B. Rohrabaugh, roadmaster on the Chicago, Indianapolis & Louisville (the Monon), with headquarters at Lafayette, Ind., died on June 23 at the age of 57 years.

A. E. Harvey, former division engineer of several western railroads and since 1911 chief engineer of the Kansas City Public Service Company, died at Kansas City, Mo., on July 3.

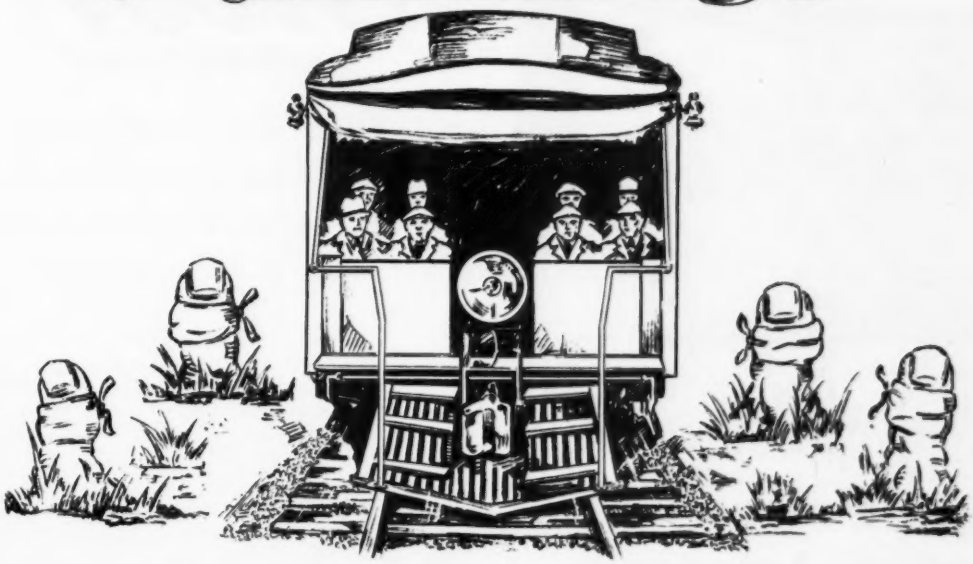
J. B. Clarke, former master carpenter on the Baltimore & Ohio, with headquarters at Chillicothe, Ohio, who retired from active service in 1925, died at Springfield, Ohio, on May 20.

James E. Howard, who had been engineer-physicist of the Bureau of Safety of the Interstate Commerce Commission, with headquarters at Washington, D. C., since 1914, died on July 6 at his home at North Conway, N. H., in his eightieth year. He was born at Palmer, Mass., on June 26, 1851, and was educated at Nichols Academy, Dudley, Mass., and at Highland Military Academy, Worcester, Mass. His first railroad experience was on location work on the St. Paul & Pacific, after which he was engaged in civil engineering at Boston, Mass., and mechanical engineering at Chicopee, Mass. From 1880 to 1910 Mr. Howard served as engineer in charge of tests at the government arsenal at Watertown, Mass., and from 1910 to 1914 was connected with the Bureau of Standards in Washington.

T. H. Gordon, assistant engineer maintenance of way and structures, on the Baltimore & Ohio, with headquarters at Baltimore, Md., died in that city on April 19. Mr. Gordon was born on September 15, 1888, at Parkersburg, W. Va., and obtained his engineering education from the University of Ohio, from which he graduated with a degree in civil engineering. He commenced his railway career on April 1, 1910, as a rodman in the engineering department of the B. & O. at Wheeling, W. Va., remaining with this road continuously until his death. He served as rodman at several locations until 1913, when he was promoted to transitman, with headquarters at Baltimore, being then in 1915 advanced to assistant supervisor of track at Havre de Grace, Md. In 1917, Mr. Gordon was further promoted to assistant division engineer, with headquarters at Philadelphia, Pa., and a year later he was made division engineer of the Charleston division, with headquarters at Gassaway, W. Va., being on September 1, 1919, promoted to assistant engineer maintenance of way and structures at Baltimore.

H. L. Johnson, division engineer on the Smithers division of the Canadian National, with headquarters at Tete Jaune, B. C., died on June 2 at New Westminister, B. C., from what is believed to have been a heart attack. He was born on August 29, 1862, at Fredericton, N. B., and commenced his railway career with the engineering department of the Canadian Pacific in 1882. He served as chainman and resident engineer until 1888, when he resigned to become an instrumentman and resident engineer on the Great Northern in Washington. In 1893 he returned to the C. P. R. as assistant engineer and roadmaster, then going with the Grand Trunk Pacific (now part of the Canadian National) in 1905, where he served successively as locating and division engineer. In 1911, Mr. Johnson was appointed division engineer on the Canadian Northern (now also part of the Canadian National), resigning in 1917 to accept a position as district engineer with the British Columbia Water Works Department. In 1919 he entered the service of the Canadian National as a division engineer, being appointed acting district engineer at Victoria, B. C., in 1927, where he remained until March 31, 1929, when he retired. However, he re-entered the service on May 7 of the same year as division engineer at Tete Jaune, which position he retained until his death.

ATLACIDE
CALCIUM CHLORATE

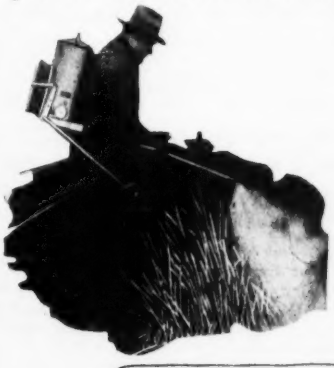


Weed Patches Stand Out Like Sore Thumbs When the Eagle Eyes Pass Over Your Division for Fall Inspection

DUST away all scattered weed patches for they will stand out like so many sore thumbs at fall inspection and spoil the appearance and high rating of an otherwise fine roadbed.

Supply every section foreman with a handy Knapsack Duster and kill off the weed patches around switch stands, ditches, culverts, stations, cattle guards and other weed-infested areas. It will put the finishing touches to your track.

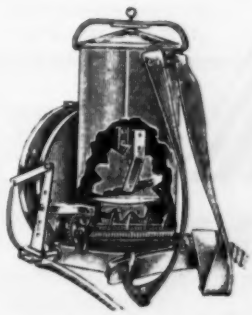
One man can apply powdered Atlacide Calcium Chlorate and get results. It does away with the heavy cumbersome liquid sprayer because no water is necessary.



THE NEW KNAPSACK WEED KILLER DUSTER

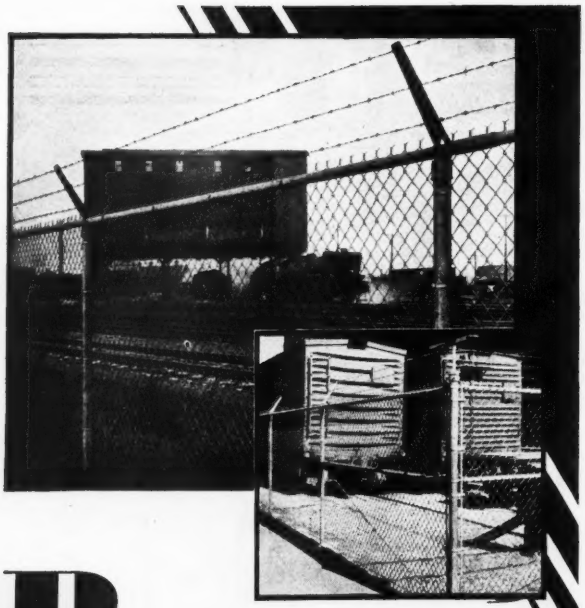
weighs only 16 pounds empty — 41 pounds when loaded and does the work of a sprayer containing 220 pounds of liquid. It covers 5000 square feet of vegetation with one filling.

Act quickly for best results.



Chipman Chemical Engineering Co. Inc.
BOUND BROOK, N. J.

Chicago, Ill. Palo Alto, Cal. Houston, Tex. Atlanta, Ga. Kansas City, Mo. Winnipeg, Man.



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The lasting qualities of Page Fence make it the lifetime fence of real protection—safeguarding railroad property at a minimum cost per year of service.

Page Fence is the only fence available of durable Armco Ingot Iron, the highest type of rust-resistant iron known. For the heavier fence constructions, where more than ordinary abuse is involved, Page H-Section Line Posts are recommended.

Page also manufactures a complete line of Ornamental Wrought Iron (not steel) Fences and Gates. Special literature on request.

64 Service Plants erect Page Fence everywhere. Send for special literature and for name of company nearest you. This involves no obligation. Address Page Fence Association, 520 No. Michigan Avenue, Dept. B34, Chicago, Illinois.

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America's first wire fence since 1883

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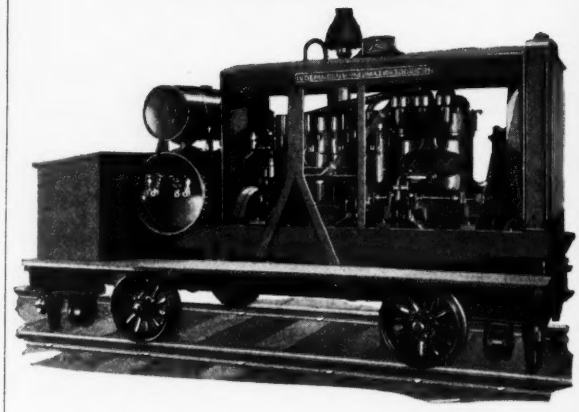
The Compressor that Has Established a New Standard of Efficiency



The Super Charger Does It!

The Thor is the most powerful and most compact compressor of its size on the market. It is the only compressor with a Super-Charger, which enables it to deliver 26% more working air than any other compressor of the same capacity.

The Super-Charger feature of the Thor is not just "sales talk". It means more actual air delivery so that you can run that many more track tools. It also means lower original cost as well as lower operating and maintenance costs.

Furthermore, the Thor "6" eliminates bulkiness and trouble because it is a single direct-connected unit. Both engine and compressor are mounted on one crank case, eliminating gears, clutches and couplings.

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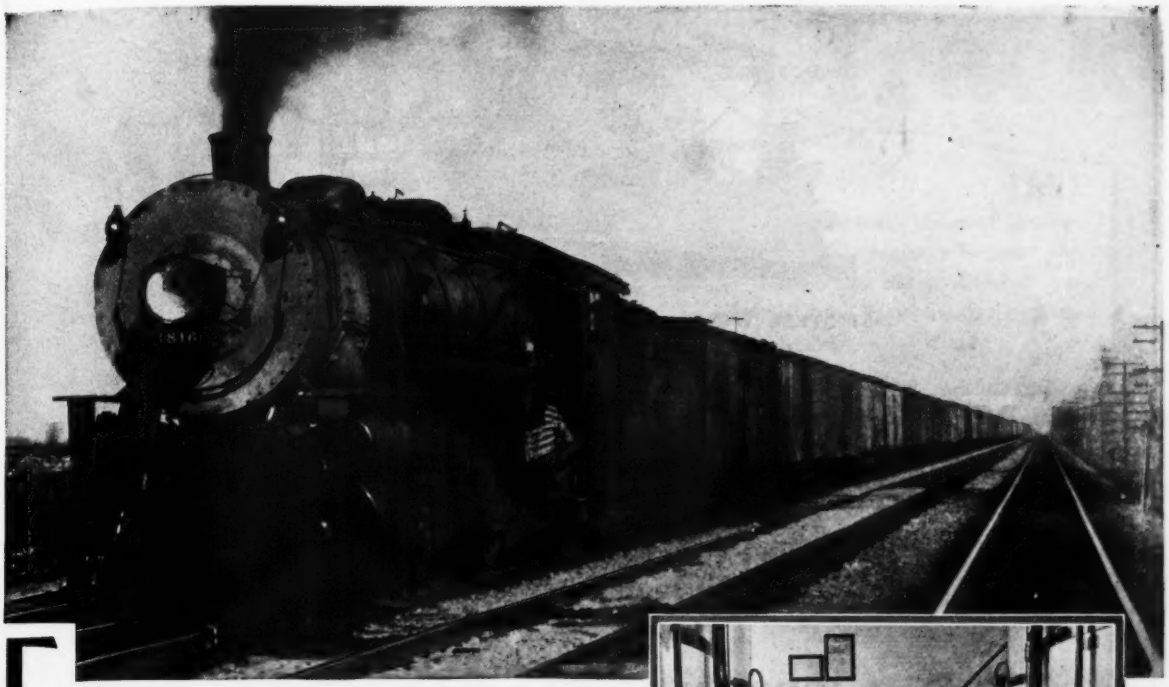
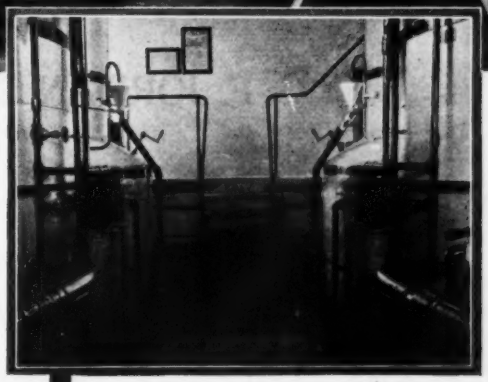


EFFICIENCY



Double installation of Oxweld 500-pound Duplex Balanced Seal Acetylene Generators in Standard Oxweld Railroad Service building.

By providing the best instruction, supervision, apparatus, and materials, Oxweld Railroad Service insures utmost efficiency in railroad oxwelding and cutting operations.

For example, Oxweld Railroad Service Engineers know that, despite training in every phase of welding and cutting, an operator can do efficient work only when he has a dependable, steady gas supply. They make thorough studies of present and probable future requirements and without capital investment by the railroad construct or install acetylene generating and oxygen distributing equipment, including generator and cylinder storage houses and oxwelded piping systems to deliver welding gases to the operating stations. The operator, freed from possibility of interruption, can concentrate on the job.

Oxweld Railroad Service overlooks nothing conducive to efficient application of the oxy-acetylene process to railroad work. That is why the majority of Class I roads contract for it year after year.

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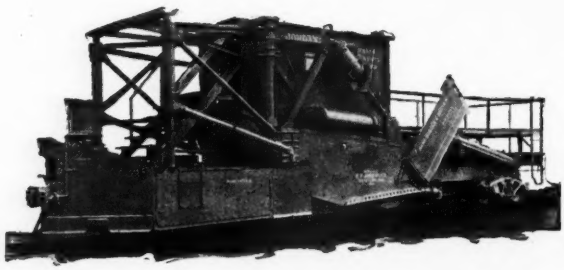

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NEW JORDAN TYPE "A" SPREADER-DITCHER

Meets Every Railway Spreading and Ditching Requirement

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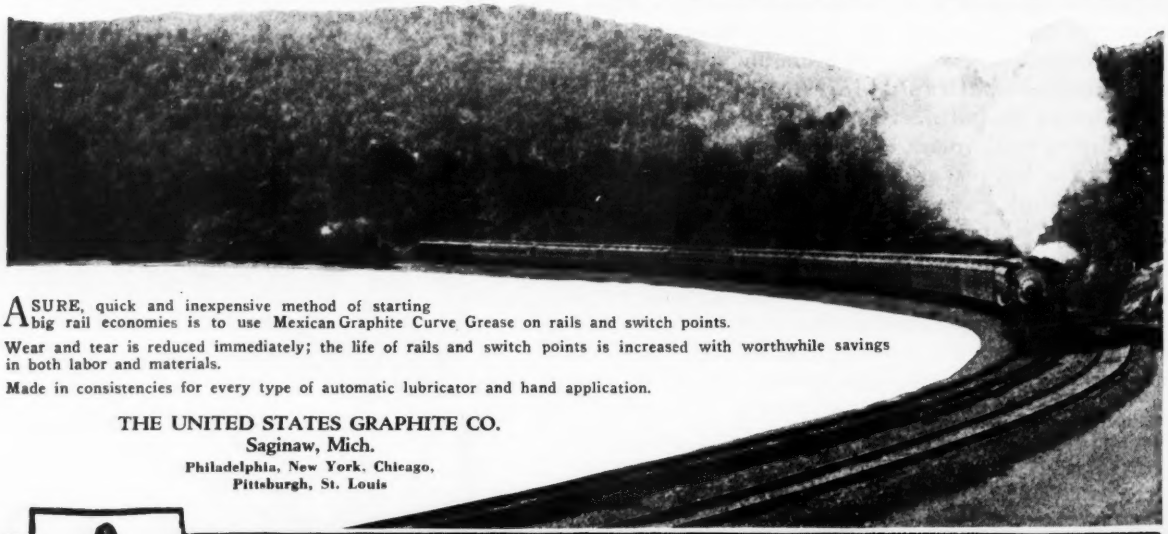
Rail Economies Start Immediately with the Application of MEXICAN GRAPHITE CURVE GREASE



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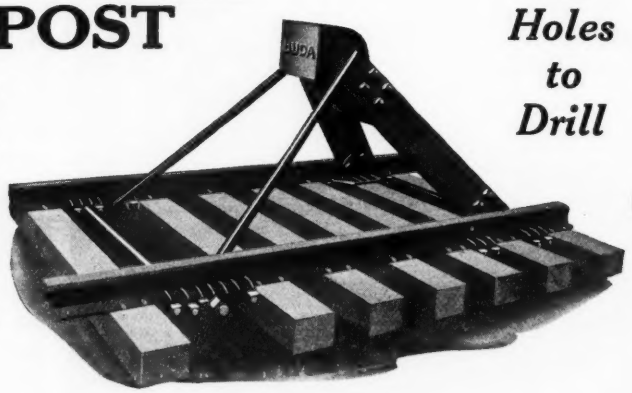

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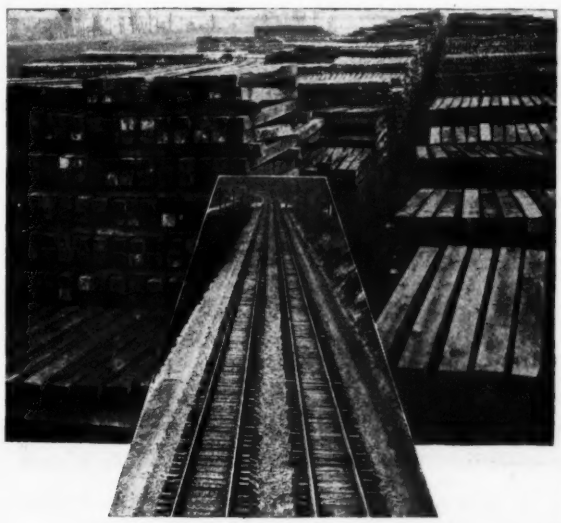

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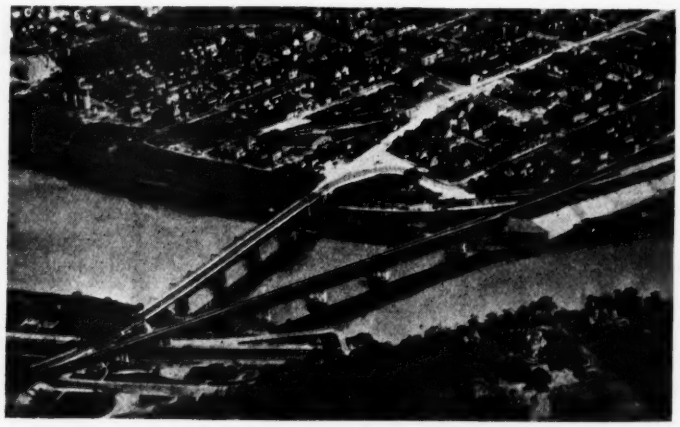

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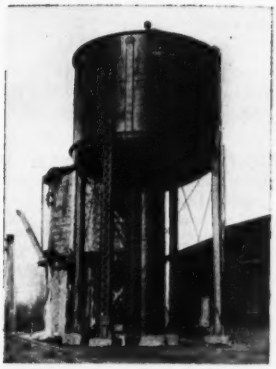

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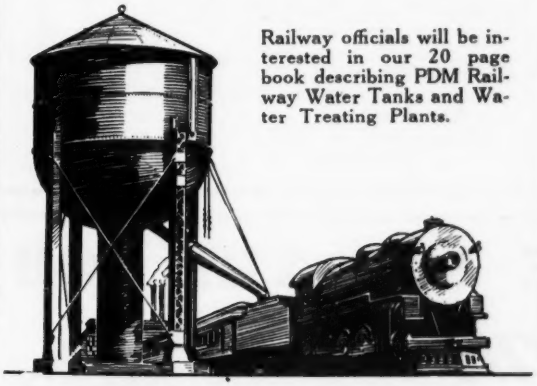

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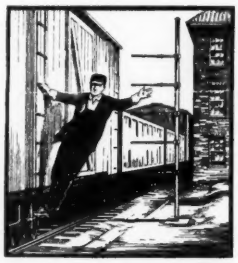

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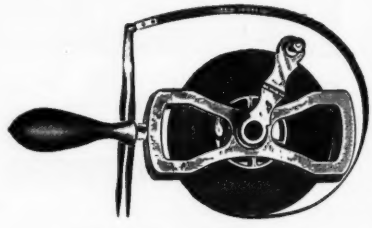

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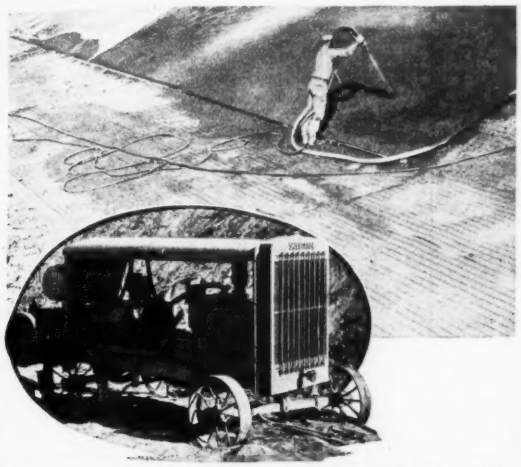

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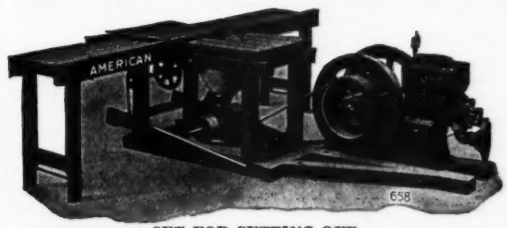

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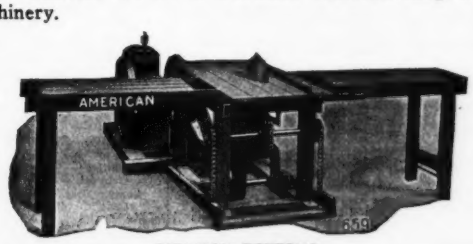

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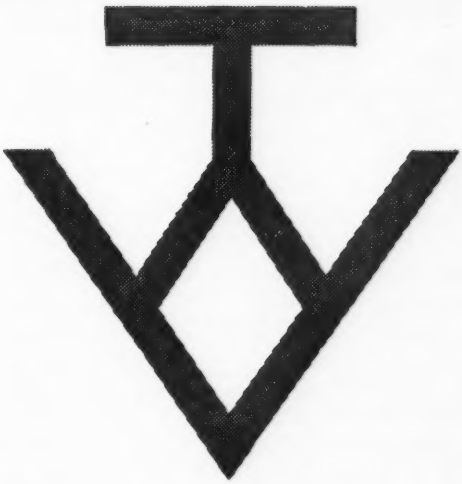

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Established 1873

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A *new* Steel Tie

for reinforcing wood-tie track

The new Keystone Steel Tie No. 17 is used to reinforce wood-tie track. Substituted for every third or fourth wood tie. These metal ties carry the full strain of the rail fastenings, add years to the life of the wood ties and hold the track true to gage and in alignment. On curves and steep grades Keystone Steel Ties may be used as stiffeners and to replace gage rods. They prevent spreading or rolling over of the rails, thus reducing the possibility of derailment.

The Keystone Steel Tie has a much longer life than wood ties and considerably reduces tie renewals. Keystone Steel Ties do not become spike-killed or cracked and will not burn out. Use them in sidings, yards, cinder dumps, round houses, and at water tanks and other locations where wood ties have comparatively short life.

The Keystone Steel Tie No. 17 is made of copper-bearing steel. The tie is channel-shaped, with a deep, depressed rib running longitudinally through the center and a heavy reinforcing bulb at the bottom of the sides. The ends are depressed and flared in the shape of a "whale-tail," giving the tie a firm grip on the ballast and preventing lateral motion of the track.

The rolled steel tie-plates are electric spot-welded to the tie, resulting in solid one-piece construction, and reinforcing the tie where reinforcement is most needed, beneath the rails. This construction eliminates rivets and provides greater strength.

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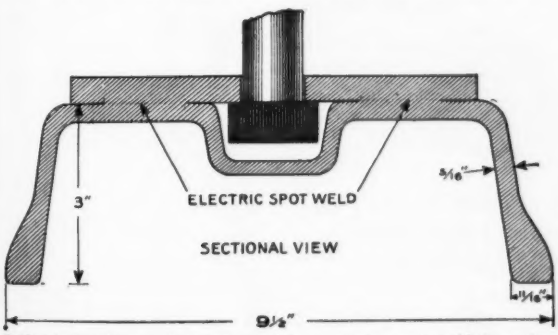
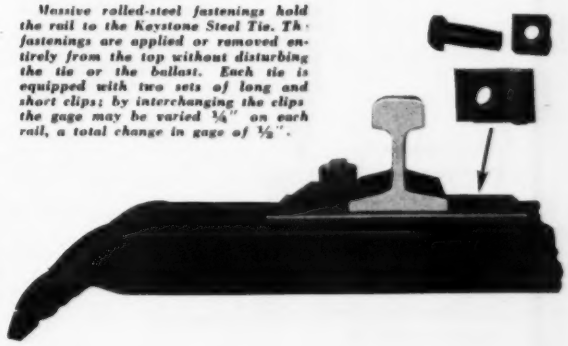


Each of the Heavy rolled-steel tie plates is electric spot welded to the tie, reinforcing it beneath the rails.

Massive rolled-steel fastenings hold the rail to the Keystone Steel Tie. The fastenings are applied or removed entirely from the top without disturbing the tie or the ballast. Each tie is equipped with two sets of long and short clips; by interchanging the clips the gage may be varied ¼" on each rail, a total change in gage of ½".



BETHLEHEM

Keystone Steel Tie No. 17

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Ultimately costs less

Timken Bearings Show Section Car Savings

Maintenance equipment should set a good example. It should require very little maintenance attention.

Fairbanks, Morse & Company, Chicago, have appraised the situation correctly, and have provided for it effectively by mounting their entire line of Sheffield section cars on Timken Bearing Equipped wheels.

With the frictional load thus eliminated, lubricant is saved, wear is negligible, cutting of axles is prevented, dependability is assured, wheels last longer and maintenance charges are radically revised.

In "Sheffield" section motor cars, additional economies have been secured by mounting the engine crank shaft on Timken Bearings. Fuel consumption is reduced, lubrication requirements are lowered and, furthermore, there is a decided increase in endurance, because the crank shaft is permanently held in rigid alignment and is thoroughly protected against uneven cylinder pressures, shocks and thrust loads.

As a result of the exclusive combination of Timken tapered construction, Timken positively aligned rolls and Timken-made steel, Timken is a bearing that possesses the capacity to carry all loads at the same time—radial, thrust or both together.

THE TIMKEN ROLLER BEARING CO., CANTON, OHIO

TIMKEN *Tapered Roller* **BEARINGS**

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